In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS
No. 17-1254V
Filed: August 27, 2024

WILLIAM BARTOSZEK,

Petitioner,

v.

SECRETARY OF HEALTH AND HUMAN SERVICES,

Respondent.

Special Master Horner

Anne Carrion Toale, Maglio Christopher and Toale, PA, Sarasota, FL, for petitioner.
Neil Bhargava, U.S. Department of Justice, Washington, DC, for respondent.

RULING ON ENTITLEMENT[1]

On September 14, 2017, petitioner, William Bartoszek, filed a petition under the National Childhood Vaccine Injury Act, 42 U.S.C. § 300aa-10, *et seq.* (2012),[2] alleging that he suffered Guillain-Barré Syndrome ("GBS") caused-in-fact by a Prevnar 13 vaccination he received on July 13, 2016. (ECF No. 1.) For the reasons set forth below, I conclude that petitioner is entitled to an award of compensation.

I. Applicable Statutory Scheme

Under the National Vaccine Injury Compensation Program, compensation awards are made to individuals who have suffered injuries after receiving vaccines. In general, to gain an award, a petitioner must make a number of factual demonstrations, including showing that an individual received a vaccination covered by the statute; received it in the United States; suffered a serious, long-standing injury; and has

[1] Because this document contains a reasoned explanation for the action taken in this case, it must be made publicly accessible and will be posted on the United States Court of Federal Claims' website, and/or at https://www.govinfo.gov/app/collection/uscourts/national/cofc, in accordance with the E-Government Act of 2002. 44 U.S.C. § 3501 note (2018) (Federal Management and Promotion of Electronic Government Services). **This means the document will be available to anyone with access to the internet.** In accordance with Vaccine Rule 18(b), Petitioner has 14 days to identify and move to redact medical or other information, the disclosure of which would constitute an unwarranted invasion of privacy. If, upon review, I agree that the identified material fits within this definition, I will redact such material from public access.

[2] Within this ruling, all citations to § 300aa will be the relevant sections of the Vaccine Act at 42 U.S.C. § 300aa-10-34.

received no previous award or settlement on account of the injury. Finally – and the key question in most cases under the Program – the petitioner must also establish a *causal link* between the vaccination and the injury. In some cases, the petitioner may simply demonstrate the occurrence of what has been called a "Table Injury." That is, it may be shown that the vaccine recipient suffered an injury of the type enumerated in the "Vaccine Injury Table," corresponding to the vaccination in question, within an applicable time period following the vaccination also specified in the Table. If so, the Table Injury is presumed to have been caused by the vaccination, and the petitioner is automatically entitled to compensation, unless it is affirmatively shown that the injury was caused by some factor other than the vaccination. § 300aa-13(a)(1)(A)-(B); § 300 aa-11(c)(1)(C)(i); § 300aa-14(a).

In many cases, however, the vaccine recipient may have suffered an injury *not* of the type covered in the Vaccine Injury Table. In such instances, an alternative means exists to demonstrate entitlement to a Program award. That is, the petitioner may gain an award by showing that the recipient's injury was "caused-in-fact" by the vaccination in question. § 300aa-11(c)(1)(C)(ii). In such a situation, of course, the presumptions available under the Vaccine Injury Table are inoperative. The burden is on the petitioner to introduce evidence demonstrating that the vaccination actually caused the injury in question. *Althen v. Sec'y of Health & Human Servs.*, 418 F.3d 1274, 1278 (Fed. Cir. 2005); *Hines ex rel. Sevier v. Sec'y of Health & Human Servs.*, 940 F.2d 1518, 1525 (Fed. Cir. 1991).

The showing of "causation-in-fact" must satisfy the "preponderance of the evidence" standard, the same standard ordinarily used in tort litigation. § 300aa-13(a)(1)(A); *see also Althen*, 418 F.3d at 1279; *Hines*, 940 F.2d at 1525. Under that standard, the petitioner must show that it is "more probable than not" that the vaccination was the cause of the injury. *Althen*, 418 F.3d at 1279 (citations omitted). The petitioner need not show that the vaccination was the sole cause of the injury or condition but must demonstrate that the vaccination was at least a "substantial factor" in causing the condition and was a "but for" cause. *Shyface ex rel. Shyface v. Sec'y of Health & Human Servs.*, 165 F.3d 1344, 1352 (Fed. Cir. 1999). Thus, the petitioner must supply "proof of a logical sequence of cause and effect showing that the vaccination was the reason for the injury;" the logical sequence must be supported by "reputable medical or scientific explanation, *i.e.*, evidence in the form of scientific studies or expert medical testimony." *Althen*, 418 F.3d at 1278 (citing *Grant ex rel. Grant v. Sec'y of Health & Human Servs.*, 956 F.2d 1144, 1148 (Fed. Cir. 1992)). A petitioner may not receive a Vaccine Program award based solely on her assertions; rather, the petition must be supported by either medical records or by the opinion of a competent physician. § 300aa-13(a)(1).

In what has become the predominant framing of this burden of proof, the *Althen* court described the "causation-in-fact" standard, as follows:

> Concisely stated, Althen's burden is to show by preponderant evidence that the vaccination brought about her injury by providing: (1) a medical

> theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of proximate temporal relationship between vaccination and injury. If Althen satisfies this burden, she is entitled to recover unless the [government] shows, also by a preponderance of the evidence, that the injury was in fact caused by factors unrelated to the vaccine.

Althen, 418 F.3d at 1278 (citations omitted). The *Althen* court noted that a petitioner need not necessarily supply evidence from medical literature supporting her causation contention, so long as the petitioner supplies the medical opinion of an expert. *Id*. at 1279-80. That expert's opinion must be "sound and reliable." *Boatmon v. Sec'y of Health & Human Servs*., 941 F.3d 1351, 1359-60 (Fed. Cir. 2019) (citing *Knudsen ex rel. Knudsen v. Sec'y of Health & Human Servs.*, 35 F.3d 543, 548-49 (Fed. Cir. 1994)). The *Althen* court also indicated, however, that a Program fact-finder may rely upon "circumstantial evidence," which the court found to be consistent with the "system created by Congress, in which close calls regarding causation are resolved in favor of injured claimants." 418 F.3d at 1280 (citations omitted).

Generally, respondent bears the burden of demonstrating the presence of any alternative cause by preponderant evidence only if petitioner satisfies her *prima facie* burden. § 300aa-13(a)(1)(B); *Walther v. Sec'y of Health & Human Servs*., 485 F.3d 1146, 1150 (Fed. Cir. 2007). However, respondent may also present evidence relating to an alternative cause to demonstrate the inadequacy of petitioner's evidence supporting her case in chief. *de Bazan v. Sec'y of Health & Human Servs*., 539 F.3d 1347, 1352-53 (Fed. Cir. 2008). Nonetheless, petitioner does not bear the burden of eliminating alternative causes where the other evidence on causation is sufficient to establish a *prima facie* case under *Althen*. *Walther*, 485 F.3d at 1150-51.

II. Procedural History

This case was originally assigned to Special Master Millman. (ECF No. 4.) Between September 2017 and December 2017, petitioner filed medical records and an affidavit. (ECF Nos. 5-6, 11, 13, 16; Exs. 1-16.) In June of 2018, respondent filed his Rule 4(c) Report arguing that the evidence presented did not meet petitioner's burden and recommending against compensation. (ECF No. 26.) Respondent did not dispute petitioner's GBS diagnosis but contended that vaccine causation was not supported. (*Id*. at 6-8.) Petitioner subsequently filed additional medical records (ECF Nos. 27, 35; Exs. 17, 50) and an expert report from neurologist Kazim A. Sheikh, M.D., with supporting literature. (ECF Nos. 29-32; Exs. 18-49.) Respondent then filed an expert report from immunologist Ross M. Kedl, Ph.D. (ECF Nos. 36-38; Exs. A-B.) In doubting that petitioner suffered vaccine-caused GBS, Dr. Kedl opined, *inter alia*, that it was more likely petitioner was suffering peripheral neuropathy due to preexisting conditions. (Ex. A, pp. 9-10.) On June 4, 2019, this case was reassigned to my docket. (ECF Nos. 39-40.)

After the case was reassigned, petitioner filed a supplemental expert report from Dr. Sheikh responding to Dr. Kedl's first report and respondent then filed a further report by Dr. Kedl. (ECF No. 41-42, 44; Exs. 51-67, C.) A Rule 5 conference was held on December 4, 2019. (ECF No. 46.) With regard to *Althen* prong two, I observed that petitioner was diagnosed by his treating neurologist with acute demyelinating polyneuropathy/GBS. (*Id.* at 1 (citing Ex. 2, p. 278-79; Ex. 16, p. 564).) Preliminarily, I indicated that I was not persuaded by Dr. Kedl's opinions that petitioner's symptoms were more likely caused by peripheral neuropathy or, assuming petitioner did have GBS, that his GBS was more likely caused by a subclinical infection. (*Id.* at 2.) Nor was I persuaded by the lack of CSF or demyelination testing, given petitioner's response to IVIg and his physicians decision to forego further diagnostics. (*Id.* at 2-3.) Dr. Kedl in his supplemental expert report had suggested that his and Dr. Sheikh's "differences of opinion boil down to whether one views the available data as an immunologist or a neurologist." (Ex. C, p. 1.) I indicated that respondent would likely need to present an opinion by a neurologist if he wished to continue challenging petitioner's correct diagnosis and the logical sequence of cause and effect presented by his clinical presentation. (ECF No. 46, p. 3.) Lastly, I noted that the main issue in this case would most likely be focused on *Althen* prong one, the medical theory. (*Id.*) On my preliminary review of the expert reports, I suggested that a hearing may be necessary to fully explore the competing opinions. (*Id.*)

Following the Rule 5 conference, petitioner filed a second supplemental expert report by Dr. Sheikh (ECF Nos. 51-52; Exs. 68-79) and additionally filed an expert report from immunologist M. Eric Gershwin, M.D. (ECF Nos. 54-55; Ex. 80-94). Respondent then responded by filing an expert report from neurologist Vinay Chaudhry, M.D., and Dr. Kedl's second supplemental expert report. (ECF Nos. 58-59; Exs. D-F.) Dr. Chaudhry opined that petitioner's diagnosed GBS "is lacking confirmatory support." (Ex. E, p. 20.) Petitioner then filed a further report by Dr. Gershwin. (ECF Nos. 62-65; Exs. 96-128.) A two-day entitlement hearing was scheduled for January 10, 2023. (ECF No. 68.) However, respondent later advised that his neurology expert, Dr. Chaudhry, would not participate further in this case. (Non-PDF Scheduling Order, filed May 4, 2021.) Respondent indicated that he intended to retain a different expert to testify at the entitlement hearing. (*Id.*) On October 20, 2021, respondent filed an expert report from neurologist Brian Callaghan, M.D., M.S. (ECF No. 73; Exs. G-H.) Dr. Callaghan conceded for the first time on respondent's behalf that petitioner likely suffered GBS. (Ex. G, p. 4.)

On February 4, 2022, I issued a scheduling order informing the parties that a ruling on entitlement by the undersigned involving GBS caused-in-fact by a Prevnar 13 vaccination was recently posted. (ECF No. 74.) I encouraged the parties to review my ruling in *Pierson,* and to confer with their clients, experts, and each other. (*Id.*) I ordered the parties to reassess their respective litigative risk and to consider whether they would like to develop the record of this case further. (*Id.*) On March 7, 2022, the parties filed a joint status report indicating that petitioner intended to further develop the record of the case. (ECF No. 75.) Petitioner indicated that he retained a new immunologist and intended to file an additional expert report. (*Id.*)

On March 14, 2022, a status conference was held wherein petitioner indicated that he retained immunologist Lawrence Steinman, M.D., to testify in place of Dr. Gershwin. (ECF No. 76.) Respondent requested the opportunity to file a responsive supplemental expert report but otherwise raised no objection. (*Id.*) Subsequently, petitioner and respondent filed supplemental expert reports from Drs. Steinman and Kedl. (ECF No. 78, 81; Exs. 129-162, I.) A prehearing order was issued on October 11, 2022, setting the close of the record for November 29, 2022. (ECF No. 82.) Subsequently, the entitlement hearing was rescheduled to commence on January 12, 2023, to accommodate respondent's expert's schedule. (Non-PDF Scheduling Order, filed Oct. 11, 2022.) In the course of prehearing submissions, petitioner filed a supplemental expert report by Dr. Steinman on November 29, 2022. (ECF No. 84; Exs. 163-177.) In response, respondent later filed medical literature marked as Exhibits J-L and a demonstrative aid marked as Exhibit M. (ECF Nos. 100, 111.) However, the hearing was ultimately continued to May 4, 2023. (ECF Nos. 114, 116.)

On March 14, 2023, petitioner filed a status report, indicating that his experts were unavailable for the rescheduled entitlement hearing. (ECF No. 117.) "Due to the age of this case, the age of Petitioner, and the previous enlargements of the hearing dates requested by both sides," petitioner requested to proceed with a motion for ruling on the written record in lieu of an entitlement hearing. (*Id.*) During a follow up status conference, respondent indicated that he did not object to proceeding on the written record so long as he was provided an opportunity to file an expert report in response to Dr. Steinman's most recent report. (ECF No. 118.) Accordingly, the entitlement hearing that was rescheduled for May 4, 2023, was cancelled. (*Id.*)

On April 18, 2023, petitioner filed a motion for ruling on the record pursuant to Vaccine Rule 8(d). (ECF No. 119.) On June 20, 2023, respondent filed a supplemental expert report by Dr. Kedl (ECF No. 122; Ex. N), and a response to petitioner's motion for ruling on the record (ECF No. 123). Petitioner filed his reply on September 6, 2023. (ECF No. 126.)

In light of the above, I have determined that the parties have had a full and fair opportunity to present their cases and that it is appropriate to resolve entitlement on the existing record. *See* Vaccine Rule 8(d); Vaccine Rule 3(b)(2); *see also Kreizenbeck ex rel. C.J.K. v. Sec'y of Health & Human Servs.*, 945 F.3d 1362, 1366 (Fed. Cir. 2020) (noting that "special masters must determine that the record is comprehensive and fully developed before ruling on the record"). Accordingly, this matter is now ripe for resolution.

III. Factual History

a. As reflected in the medical records

Petitioner was seventy-three years old when he received the Prevnar 13 vaccine during a primary care appointment on July 13, 2016. (Ex. 1, p. 1.) Petitioner's pre-

vaccination history was significant for ischemic cardiomyopathy, coronary artery disease, status-post coronary artery bypass graft and stent placement, congestive heart failure, hypertension, paroxysmal atrial fibrillation, prostatic hypertrophy, chronic lower extremity edema, diabetes mellitus, smoking, and obesity. (Ex. 2, pp. 2, 8, 195, 251, 275.) Petitioner presented to his cardiologist for a follow-up visit on July 25, 2016. (*Id.* at 195.) He reported a few months of exertional dyspnea but no other new symptoms. (*Id.* at 195-98.)

On August 5, 2016, petitioner presented to the emergency department with complaints of acute back pain that had been waxing and waning for the past two days. (Ex. 2, p. 274.) He also reported numbness and tingling in his hands and feet after starting Crestor for better lipid control one week earlier. (*Id.*) He had a markedly elevated blood pressure, for which he was treated. (*Id.* at 275-76.) Petitioner was admitted to rule out acute coronary syndrome and dissecting aortic aneurysm. (*Id.* at 276.) Following admission, petitioner experienced chest pain and respiratory distress, prompting his transfer from the medical floor to the intensive care unit. (*Id.* at 278.)

A CT scan of petitioner's chest with contrast showed cardiomegaly and pulmonary fibrotic changes with no acute process. (Ex. 2, pp. 217-18.) Petitioner's physical exam was normal except for IV/VI systolic murmur and 1-2+ edema in his lower extremities. (*Id.* at 275.) His neurologic exam revealed no focal deficits. (*Id.*) The assessment included hypertensive crisis, which was assumed to account for his numbness, and unstable angina. (*Id.* at 276.) It was noted that his numbness and tingling had resolved. (*Id.*)

Petitioner saw neurologist Steve Dofitas, M.D., on August 6, 2016, for weakness and tingling in the extremities that began three days earlier. (Ex. 2, p. 278.) Petitioner described progressing weakness in his upper and lower extremities and numbness that extended from his lower extremities to his trunk. (*Id.*) He also reported numbness in his tongue and difficulty with eating and swallowing that began the previous evening. (*Id.*) The immunization history noted that petitioner "received immunization for flu and also for pneumonia 2 weeks" earlier.[3] (*Id.*) On exam, petitioner exhibited 4/5 strength in all extremities with the exception of 3/5 in his ankles. (*Id.* at 279.) He had sensory impairment in his lower extremities up to the level of his umbilicus and to his elbows in the upper extremities. (*Id.*) Deep tendon reflexes were absent throughout. (*Id.*) His gait was not tested. (*Id.*) Dr. Dofitas' impression was distal weakness and sensory impairment with absent deep tendon reflexes and back pain. (*Id.*) Dr. Dofitas opined that petitioner "likely has acute demyelinating polyneuropathy, the onset of which was about 3 days ago." (*Id.*)

Petitioner underwent a CT scan of his head, which was negative. (Ex. 2, p. 211.) A cardiology progress note, dated August 6, 2016, noted that petitioner had developed progressive numbness and weakness from his diaphragm and that a neurological evaluation had been called for possible GBS. (Ex. 16, p. 608.) The report also noted

[3] There is no record of a flu immunization, and petitioner does not allege in his petition that he received a flu vaccine at the same time that he received the Prevnar 13 vaccine. (*See* Exs. 1, 95.)

that petitioner had "received [a] Pneumonia shot 2 weeks" earlier. (*Id.*) Petitioner was started on IVIg and his weakness improved. (*Id.* at 519, 524.) He was transferred from the intensive care unit to the medical floor on August 8, 2016, where he completed a five-day course of IVIg. (*Id.* at 531, 561.) He still had difficulty ambulating, but his sensation was slowly returning to normal. (*Id.* at 531.)

On August 11, 2016, petitioner was discharged to inpatient rehabilitation with the following diagnoses: GBS, hematuria, hypertension, coronary artery disease, diabetes mellitus, gastroesophageal reflux, hyperlipidemia, and thrombocytopenia. (Ex. 7, p. 8.) At this point, petitioner required moderate assistance for sit to stand transfers and maximum to moderate assistance for lower body dressing and bathing. (*Id.* at 20.) Additionally, petitioner could only ambulate approximately three feet. (*Id.*) By August 31, 2016, petitioner's ambulation had improved to 200 feet at a minimal assist level with a rolling walker and stair navigation at a moderate assist. (*Id.*) It was noted that, despite making functional gains, petitioner continued to struggle with stair navigation and would likely require an ankle brace for mediolateral instability during his outpatient rehabilitation. (*Id.*)

Following his stay at the hospital acute rehabilitation center, petitioner was admitted to a subacute rehabilitation facility on September 1, 2016. (Ex. 5, p. 15.) During his subacute rehabilitation, petitioner participated in physical therapy without any specific complications. (Ex. 2, p. 291.) He was discharged from subacute rehabilitation on September 16, 2016, with a diagnosis of, inter alia, unspecified demyelinating disease of the central nervous system. (*Id.* at 290.) The discharge exam showed significantly diminished grip strength and proximal lower extremity muscle weakness. (*Id.* at 292.) Petitioner was able to stand for 5-6 minutes and was independent with self-feeding and bathing using a tub bench, no further therapy was recommended. (Ex. 5, p. 35.) The discharge summary noted that he had developed lower extremity weakness 1-2 weeks after receiving the Prevnar 13 vaccine. (Ex. 2, p. 291.)

Petitioner had an outpatient rehabilitation evaluation on September 21, 2016. (Ex. 2, p. 202.) He was ambulating with a rolling walker but was unable to use the stairs. (*Id.*) He had weakness in both legs, as well as numbness and tingling in his legs, forearms, face, and back of his head. (*Id.*) His sensory exam was normal to light touch, with diminished strength in the lower extremities and diminished deep tendon reflexes bilaterally. (*Id.*) His gait was slow and abnormal. (*Id.* at 203.)

On September 29, 2016, petitioner saw his primary care physician, who noted his recent GBS diagnosis. (Ex. 2, p. 204.) His urinary retention had resolved, but he had continued weakness in his lower extremities and impaired sensation. (*Id.*) Pneumococcal vaccine was listed as an allergy. (*Id.*)

Petitioner underwent an esophagram with barium on October 3, 2016, which showed mild esophageal dysmotility. (Ex. 2, p. 207.) Petitioner returned to his primary

care physician on October 11, 2016. (Ex. 7, p. 35.) He was taking Gabapentin[4] and ambulating with an assistive device. (*Id.*) His exam showed 5/5 muscle strength in all extremities and normal sensory, temperature, and pinprick testing in all extremities with no gait ataxia. (*Id.* at 36.) His primary care physician assessed improving GBS. (*Id.* at 37.) Thereafter, petitioner self-discharged from skilled physical therapy on October 17, 2016, after eight sessions. (Ex. 11, p. 5.) He was happy with his progress and reported less numbness and tingling, with the majority of his symptoms localized to his fingers and hands. (*Id.*) He was still considered high risk for falls and using a quad cane to navigate stairs and a rollator at home. (*Id.*)

On November 2, 2016, petitioner's primary care physician noted that petitioner "was given [a] Prevnar 13 injection in [his] office on July 13, 2016." (Ex. 11, p. 7.) "Approximately 3 weeks later[, petitioner] was admitted to Mercy Hospital from 8/5-8/31/16 due to Guillain Barre Syndrome." (*Id.*) He reported that his numbness in his torso had subsided, but he continued to experience numbness and tingling in his hands, legs, and face. (*Id.*) Although he described numbness in his bilateral lower extremities that radiated from his thighs down, he stated that he had feeling in his feet and was "more steady." (*Id.*) Petitioner's assessment included GBS and type 2 diabetes myelitis with diabetic peripheral angiopathy. (*Id.* at 11.) At a follow up appointment on December 13, 2016, petitioner continued to complain of weakness in his left leg due to GBS. (*Id.* at 15.) He also complained of left knee pain with localized swelling that was aggravated by descending the stairs. (*Id.*)

On January 18, 2017, petitioner returned to his primary care physician for an annual exam. (Ex. 9, p. 6.) He was walking better, despite continued tingling in his legs and feet and numbness in his lower legs and ankles. (*Id.*) He was also regaining strength in his hands and fingers, despite continued tingling in his fingers. (*Id.*) He reported a recent fall due to balance issues secondary to GBS and continued difficulty navigating stairs. (*Id.* at 7.) On exam, it was noted that petitioner was obese but had normal sensation to nylon filament to his feet for diabetic testing, normal grip strength, and equal and symmetric deep tendon reflexes. (*Id.* at 8-9.) Petitioner was diagnosed with GBS and advised to decrease his Gabapentin dosage "as he sees fit." (*Id.* at 12.)

There was no mention of weakness or sensory impairment during a March 30, 2017, encounter with petitioner's cardiologist. (Ex. 15, pp. 3-5.) He had a normal cardiac exam, neurologic exam, and normal gait. (*Id.* at 4.) The assessment was coronary artery disease. (*Id.*)

During an April 19, 2017, encounter with his primary care physician, petitioner reported continued balance issues and difficulty getting up from squatting, sitting, and laying. (Ex. 15, p. 7.) He noted that, although he was better, he was not back to baseline. (*Id.*) He also reported a 10-day history of cold-like symptoms, including

[4] Gabapentin is an orally administered anti-convulsant that is used treatment of partial seizures and in management of postherpetic neuralgia. *Gabapentin*, DORLAND'S MEDICAL DICTIONARY ONLINE, https://www.dorlandsonline.com/dorland/definition?id=19523&searchterm=gabapentin (last visited June 2, 2024).

cough, sinus pressure, eye pressure, and diarrhea, that were not responding to over-the-counter cough medicine. (*Id.*) Petitioner's assessment included GBS, and he was directed that he could decrease or discontinue Gabapentin "as he sees fit." (*Id.* at 11.) On April 27, 2017, petitioner returned to his primary care physician with no specific complaints. (Ex. 10, p. 4.) His primary care physician noted that the transient urinary retention associated with petitioner's GBS had resolved and that petitioner had a history of incomplete bladder emptying, which was stable. (*Id.*) Petitioner denied incontinence. (*Id.*)

On October 2, 2017, petitioner reported to his cardiologist that he was feeling well and was able to garden and mow the lawn. (Ex. 15, p. 20.) His primary care physician noted on October 31, 2017, that petitioner "developed Guillain Barre syndrome from a Prevnar 13 immunization in July 2016." (*Id.* at 29.) He was developing flexion contractures in his right 3rd and 4th digits as well as left 2nd and 3rd digits, which were attributed to GBS. (*Id.*) His HbA1C was 6.6 (normal reference range 4-6). (*Id.* at 33.) Petitioner was ordered to continue Gabapentin for his neuropathy. (*Id.*)

IV. Summary of Expert Opinions and Qualifications

Each party presented opinions by three different experts, filing a total of fourteen expert reports in support of their respective positions. Petitioner initially presented the expert opinion of the neurologist, Kazim Sheikh, M.D. (Exs. 18, 51, 68, 106), and immunologist, M. Eric Gershwin, M.D. (Exs. 80, 96). However, he later changed his approach to the case and introduced new theories by neuroimmunologist, Lawrence Steinman, M.D. (Exs. 129, 163.) Respondent initially presented the expert opinion of immunologist, Ross M. Kedl, Ph.D. (Exs. A, C, D, I, N), and neurologist, Vinay Chaudhry, M.D. (Ex. E.) However, Dr. Chaudhry was unable to continue the case and respondent introduced the opinion of neurologist, Brian C. Callaghan, M.D. (Ex. G.)

In their briefs, the parties raised issues with specific experts' qualifications to opine on certain topics. (ECF No. 119, pp. 12-19; ECF No. 123, pp. 14-17; ECF No. 126, pp. 3-13.) Specifically, petitioner argued that Dr. Kedl, as a "non-medical expert," is not qualified to opine on the issue of diagnosis, specific causation, alternative cause, or severity, and asserts that consideration of his opinion should be limited to general causation. (ECF No. 119, p. 17.) Respondent argued that Dr. Sheikh, as a neurologist, is not qualified to opine on a causal theory based on molecular mimicry, which is immunological. (ECF No. 123, pp. 14-15.)

Because I have found for the reasons discussed under *Althen* prong one below that the theory of molecular mimicry presented by Dr. Steinman with respect to phosphoglycerol satisfies petitioner's burden of proof, it is not necessary to reach the other theories that were advanced. This includes Dr. Sheihk's separate opinion regarding molecular mimicry, in effect mooting respondent's objection regarding Dr. Sheikh's qualifications. Additionally, respondent's initial position based on the opinions of Drs. Chaudhry and Kedl was that petitioner's diagnosis of GBS was not established.

However, Dr. Callaghan subsequently agreed that petitioner was correctly diagnosed with GBS. For the reasons discussed under *Althen* prong two below, I have found that Dr. Callaghan's clinical opinion obviated much of Dr. Kedl's reasoning as to petitioner's own presentation. Those aspects of Dr. Kedl's opinion that were noted under *Althen* prong two were found not to affect the outcome based on the legal standards of the Program. Accordingly, petitioner's objection to Dr. Kedl's qualifications is likewise moot.

Because Drs. Gershwin and Chaudhry were replaced as experts by Drs. Steinman and Callaghan respectively, their opinions will not be summarized. I have, however, considered their opinions and concluded that nothing in their opinions would affect the outcome. *Moriarty ex rel. Moriarty v. Sec'y of Health & Human Servs.*, 844 F.3d 1322, 1328 (Fed. Cir. 2016) ("We generally presume that a special master considered the relevant record evidence even though he does not explicitly reference such evidence in his decision."); *see also Paterek v. Sec'y of Health & Human Servs.*, 527 F. App'x 875, 884 (Fed. Cir. 2013) ("Finding certain information not relevant does not lead to—and likely undermines—the conclusion that it was not considered."). Dr. Gershwin's two reports serve to elaborate on the molecular mimicry theory initially presented by Dr. Sheikh, which it is not necessary to reach. Upon my review, nothing in his broader discussion of GBS undermines Dr. Steinman's subsequently presented theory. Much of Dr. Chaudhry's report was dedicated to challenging petitioner's GBS diagnosis; however, respondent subsequently abandoned that line of reasoning, confirming in his response to petitioner's motion for a ruling on the written record that he is not disputing petitioner's GBS diagnosis. (ECF No. 123, p. 14.) Although Dr. Chaudhry did offer an opinion as to whether the Prevnar vaccine can cause GBS, he confirmed in his report that he was deferring to Dr. Kedl with respect to the immunologic details. (Ex. E, p. 15.) Moreover, Dr. Chaudhry exited the case before Dr. Steinman presented the theory that is addressed under *Althen* prong one, below.

a. Petitioner's Experts

i. Kazim Sheikh, M.D.[5]

[5] Dr. Sheik received his medical degree from King Edward Medical College in Lahore, Pakistan in 1987. (Ex. 177, p. 1; Ex. 19, p. 1; Ex. 18, p. 1.) He completed an internship and residency at Mayo Hospital in Lahore; an internship at Nassau County Medical Center in East Meadow, New York; a residency in neurology at the Neurological Institute at Columbia University in New York, New York; and a postdoctoral fellowship in peripheral nerve at Johns Hopkins University School of Medicine in Baltimore, Maryland. (Ex. 177, p. 1.) Dr. Sheik is a board-certified psychiatrist and neurologist with special qualification in muscle pathology, and he maintains his medical license in Texas. (*Id.* at 2; Ex. 18, p. 2.) He currently works as a professor of neurology at the University of Texas Health Sciences, and as an attending neurologist at Memorial Hermann Hospital and Lyndon B. Johnson Hospital all in Houston, Texas. (Ex. 177, p. 2.) Dr. Sheikh is a clinician-scientist with special training in neurology and peripheral nerve and a longstanding interest in immune neuropathies, including the pathogenesis of GBS, in particular. (Ex. 18, p. 1.) Since 2001, Dr. Sheikh has been continuously funded by the National Institutes of Health ("NIH") to study the pathogenesis of GBS, including three separate NIH grants that focused on understanding the pathobiology of immune neuropathies. (*Id.*) He also has authored or co-authored more than 150 publications related to GBS and other inflammatory neuropathies. (*Id.*; Ex. 177, pp. 14-35.)

Petitioner filed four expert reports from Dr. Sheikh. (Exs. 18, 51, 68, 106.) Dr. Sheikh opines that petitioner suffers from the acute inflammatory demyelinating polyradiculopathy ("AIDP") variant of GBS. (Ex. 18, p. 9.) He notes that petitioner developed acute onset of numbness in his hands and feet, followed by severe back pain, which was likely caused by inflammation in the spinal roots. (*Id.*) Dr. Sheikh notes that petitioner's initial diagnosis of aortic dissection was eventually ruled out. (*Id.*) Petitioner then developed progressive distal and proximal weakness. (*Id.*) Dr. Sheikh observes that the progression of sensory and motor symptoms was in an ascending pattern. (*Id.*) Petitioner "also developed transient weakness of bulbar and respiratory muscles as reflected by transient swallowing difficulties and respiratory distress and reduced vital capacity, respectively." (*Id.*) An exam performed by petitioner's neurologist on August 6, 2016, confirmed proximal and distal muscle weakness, sensory impairment, and loss of deep tendon reflexes. (*Id.* (citing Ex. 2, p. 278).) According to Dr. Sheikh, "[t]hese clinical features, including the distribution and progression of sensory and motor symptoms, are consistent with an acute neuropathic process." (*Id.*) Moreover, his treating neurologist opined that petitioner has the AIDP form of GBS. (*Id.*) Although, this was not confirmed by nerve conduction studies, Dr. Sheikh explains that the quick response to IVIg and subsequent course of recovery in a 73-year-old patient are consistent with AIDP. (*Id.*; Ex. 106, p. 1.) He opines that the treating physicians' decision not to perform a spinal tap and/or nerve conduction study was reasonable, "given the quick treatment response and the monophasic course of the illness."[6] (Ex. 18, p. 9.) Additionally, Dr. Sheikh suggests "the results of these studies would not have altered petitioner's management after the recovery started." (*Id.*; Ex. 68, p. 4.)

Dr. Sheikh notes that there was no evidence of preceding infection in petitioner's case. (Ex. 51, p. 3.) A careful look at the serial CBC studies, followed by admission CBC on August 5, 2016, showed WBC within normal range; and Dr. Sheikh notes that neutrophils were 78 (normal 50-75) and subsequent CBC studies showed either elevated or normal neutrophil counts with elevated WBC peaking on August 9, 2016 to >19 (normal 4-11). (*Id.* (citing Ex. 16, pp. 664-65).) These blood counts, he stresses, were performed after the onset of petitioner's neurologic symptoms and cannot be considered as a reflection of an antecedent event or infection. (*Id.*) Moreover, no infection was established throughout extensive work up during petitioner's hospital admission. (*Id.*) GBS patients that suffer from preceding infection typically have preceding symptoms, including fever, cough, sore throat, nasal discharge, or symptoms

[6] Dr. Sheikh opines that petitioner meets the Brighton clinical criteria and has level 3 certainty for GBS. (Ex. 106, pp. 2-3.) The Brighton Criteria set forth diagnostic criteria that provide different levels of certainty for the standardization of case definitions to improve vaccine safety. (*Id.* at 2 (citing James J. Sejvar et al., *Guillain-Barré Syndrome and Fisher Syndrome: Case Definitions and Guidelines for Collection, Analysis, and Presentation of Immunization Safety Data*, 29 VACCINE 599 (2011) (Ex. 108)).) A significant limitation of this criteria is that GBS follows a monophasic course that becomes evident *after* follow-up, which can limit its use in clinical diagnosis at the time of presentation. (*Id.*) The criteria, however, has several levels of confidence based on the availability of spinal fluid and EMG testing. (*Id.*) In petitioner's case, he demonstrated bilateral and flaccid weakness of the limbs; decreased or absent deep tendon reflexes in weak limbs; and a monophasic illness pattern with interval onset and nadir of weakness between 12 hours and 28 days, followed by subsequent clinical plateau. (*Id.*)

indicative of a gastrointestinal illness (diarrhea, abdominal pain, and vomiting). (*Id.* (citing M. Koga et al., *Antecedent Symptoms in Guillain-Barré Syndrome: An Important Indicator for Clinical and Serological Subgroups*, 103 ACTA NEUROLOGICA SCANDINAVICA 278, 281 (2001) (Ex. A, Tab 14, p. 4) (reporting "[p]receding symptoms were reported in 154 (88%) of the 176 patients")).) Dr. Sheikh notes that petitioner did not complain of any of the common preceding symptoms reported by Koga et al. (*Id.*)

Furthermore, Dr. Sheikh opines petitioner did not suffer from hypertensive encephalopathy. (Ex. 106, p. 4.) "The focal neurological deficits in hypertensive emergencies are due to ischemia of the brain, including ischemic or hemorrhagic strokes," and Dr. Sheikh notes that they "do not have an ascending pattern." (*Id.*) "[T]ypical hypertensive encephalopathy features include 'agitation, delirium, stupor, seizures or visual disturbances,'" none of which petitioner had. (*Id.*) Petitioner presented with symmetric sensory and motor features on both sides, therefore, in order to implicate hypertensive urgency or encephalopathy, there would have to be insult to a substantial proportion of the brain or brainstem to be ischemic. (*Id.*) That level of ischemic insult to the brain or brainstem "would be incompatible with clinically normal attention, consciousness/alertness, cognition, speech and language functions, cranial nerves and absence of other central signals." (*Id.*) Given that petitioner's chest CT did not show acute pulmonary edema or new intrinsic disease (Ex. 2, pp. 217-18), Dr. Sheikh stresses that cardiac disease, i.e., heart failure causing petitioner's shortness of breath, is not supported. (*Id.* at 2.) Dr. Sheikh notes that petitioner was treated with IVIg, a treatment that could potentially aggravate heart failure rather than improve it. (*Id.*) Although petitioner did not require mechanical ventilation, Dr. Sheikh explains that respiratory weakness, like weakness in the limb muscles, can vary in terms of severity and "only patients with severe respiratory muscle weakness with severely reduced vital capacity require mechanical ventilation." (*Id.*)

Dr. Sheikh recognizes that the precise mechanisms for the development of GBS are not completely understood. (Ex. 68, p. 3.) He explains that the general understanding is that GBS is "triggered by environmental agents in genetically susceptible hosts." (*Id.*; Ex. 18, pp. 4-5.) Dr. Sheikh explains that activation of the innate immune system is necessary to break self-tolerance and induce autoimmunity and that stimulation of the immune system via vaccination can disrupt the balance needed to maintain immunologic homeostasis, triggering host susceptibility to autoimmune disease. (Ex. 18, p. 5 (citing Hanspeter Waldner et al., *Activation of Antigen-Presenting Cells by Microbial Products Breaks Self Tolerance and Induces Autoimmune Disease*, 113 J. CLINICAL INVESTIGATION 990 (2004) (Ex. 30)).) However, the genes that impart host susceptibility to developing GBS are not firmly established, and the pathogenesis of AIDP, in particular, is not well defined. (Ex. 68, pp. 1, 3.)

Dr. Sheikh maintains the concept of molecular mimicry is the most accepted pathogenic mechanism for GBS, particularly for it its axonal variant. (Ex. 18, pp. 4, 7 (citing K. A. Sheikh et al., *Molecular Mimicry in Guillain-Barré Syndrome*, 845 ANNALS N.Y. ACAD. SCIS. 307 (1998) (Ex. 22); Hugh J. Willison, *The Immunology of Guillain-Barré Syndromes,* 10 J. PERIPHERAL NERVOUS SYSTEM 94 (2005) (Ex. 23)).) The

strongest evidence in this regard comes from studies of axonal GBS patients that follow *Campylobacter jejuni* ("*C. jejuni*") infection. (*Id.* at 7.) For example, "[*Campylobacter*] bacteria carries carbohydrate moieties that mimic peripheral nerve glycolipids called gangliosides, and patients with post-[*Campylobacter*] axonal GBS commonly have anti-ganglioside antibodies." (*Id.*) "Experimental studies demonstrate that the anti-ganglioside antibodies can produce inflammatory nerve injury mimicking axonal GBS in experimental models." (*Id.* (citing Jaap J. Plomp et al., *Miller Fisher Anti-GQ1b Antibodies: α-Latrotoxin-Like Effects on Motor End Plates*, 45 ANNALS NEUROLOGY 189 (1999) (Ex. 40); Lan He et al., *Anti-Ganglioside Antibodies Induce Nodal and Axonal Injury Via Fcγ Receptor-Mediated Inflammation*, 35 J. NEUROSCI. 6770 (2015) (Ex. 41)).) In petitioner's case, Dr. Sheikh proposes two theories of molecular mimicry: (1) a structural mimic between the carbohydrates in the Prevnar 13 vaccine and a major glycolipid in the myelin sheath, and (2) a sequential mimic between myelin protein P0 and the diphtheria toxoid protein conjugate portion of the Prevnar 13 vaccine (CRM197). (*Id.* at 7-8; Ex. 68, pp. 2-3.) However, because I have accepted Dr. Steinman's separately presented theory of molecular mimicry as discussed below, it is not necessary to further address the specific molecular mimics proposed by Dr. Sheikh. Dr. Sheikh also proposes several additional, alternative theories for how the Prevnar 13 vaccine could cause GBS. (Ex. 18, p. 8; Ex. 51, p. 4.) Again, however, it is not necessary to address these further in light of Dr. Steinman's additional opinion.

Finally, Dr. Sheikh opines that petitioner's onset approximately three weeks post-vaccination is medically acceptable, given the lag period for post-vaccination autoimmune complications. (Ex. 18, p. 9.) He explains that inciting events, such as vaccination, are considered biologically relevant if onset of neurologic symptoms occurs within 6 weeks of the inciting event. (Ex. 51, p. 2.)

ii. Lawrence Steinman, M.D.[7]

Petitioner filed two expert reports from Dr. Steinman. (Exs. 129, 163.) At the outset, Dr. Steinman notes that the theory that he proposes in this case is congruent with the theories he has provided in prior cases, in which he provided expert testimony on behalf of petitioners alleging that their GBS was caused-in-fact by the Prevnar 13 vaccine. (Ex. 129, p. 4.)

Dr. Steinman proposes two theories of molecular mimicry: (1) a structural phospholipid-based mimic, centered on the phosphoglycerol component common to phosphatidyl-ethanolamine, phosphatidyl-choline, and phosphatidylserine and (2) a sequential mimic between CRM197 (a protein component used to conjugate the

[7] Dr. Steinman received his medical degree and completed an NIH fellowship in chemical neurobiology at Harvard University, before moving on to Stanford University Hospital where he completed an internship in surgery, a residency in pediatrics, and a residency in pediatric and adult neurology. (Ex. 130, p. 1.) He is board certified in neurology. (*Id.* at 2.) He currently works a professor in the Departments of Neurology and Neurological Sciences, and Pediatrics and Genetics at Stanford University where his "research centers on how the nervous system is attacked by the immune system." (*Id.* at 1; Ex. 129, p. 3.) He has published nearly 600 articles, including 11 articles concerning molecular mimicry in which Dr. Steinman is the first author. (Ex. 130, pp. 5-48; Ex. 129, p. 1.)

pneumococcal polysaccharides in the Prevnar 13 vaccine) and an immunogenic protein carrier known as Contactin-1. (Ex. 129, pp. 6-26.) Dr. Steinman's first theory begins with the premise that antibodies to phospholipids are seen in GBS. (*Id.* at 7 (citing B. Gilburd et al., *Autoantibodies to Phospholipids and Brain Extract in Patients with the Guillain-Barre Syndrome: Cross-Reactive or Pathogenic?*, 16 AUTOIMMUNITY 23 (1993) (Ex. 141)).) Citing his own research, Dr. Steinman explains that phospholipids are components of myelin sheath that are targeted by antibodies in neuroinflammation. (*Id.* (citing Jennifer L. Kanter et al., *Lipid Microarrays Identify Key Mediators of Autoimmune Brain Inflammation*, 12 NATURE MED. 138 (2006) (Ex. 135); Peggy Ho et al., *Identification of Naturally Occurring Fatty Acids of the Myelin Sheath that Resolve Neuroinflammation*, SCI. TRANSLAT'L MED. June 6, 2012, (Ex. 136)).) In the study by Ho et al., Steinman and his colleagues demonstrated that "[l]ipids constitute 70% of the myelin sheath, and autoantibodies against lipids may contribute to the demyelination that characterizes multiple sclerosis." (*Id.* (quoting Ho et al., *supra*, at Ex. 136, p. 1).) The group used lipid antigen microarrays and lipid mass spectrometry to identify lipid targets of the autoimmune response in a multiple sclerosis ("MS") brain and in an animal model of MS. (*Id.* (citing Ho et al., *supra*, at Ex. 136, p. 1).) Ho et al., "found that autoantibodies in MS target a phosphate group in phosphatidylserine and oxidized phosphatidylcholine derivatives." (*Id.* (citing Ho et al., *supra*, at Ex. 136, p. 1).) The main target of the human immune response to the myelin lipids was the phosphoglycerol component. (*Id.* (citing Ho et al., *supra*, at Ex. 136, p. 1).)

Prior to the study by Ho et al., Gilburd et al. published results demonstrating that 6 out of 16 GBS sera had autoantibodies to one or more of the antigens studied, which included phosphatidyl-ethanolamine, phosphatidyl-choline, and phosphatidylserine. (Ex. 129, pp. 7-8 (citing Gilburd et al., *supra*, at Ex. 141).) The Gilburd study did not identify these molecules as the cause of GBS. (*Id.* at 8 (citing Gilburd et al., *supra*, at Ex. 141).) Instead, the authors concluded, "We believe that the autoantibodies found in 6 of the 16 GBS patients [were] produced as a result of the myelin damage, rather than the cause of the inflammatory demyelination." (*Id.* (quoting Gilburd et al., *supra*, at Ex. 141, p. 6).) Dr. Steinman counters this conclusion and explains that, "[a]s so often happens as science progresses, in light of later findings . . . their 'belief' can be re-interpreted based on the body of scientific evidence that emerged after their study." (*Id.*) Dr. Steinman suggests the Gilburd et al. study's observations were accurate, "but their 'beliefs' might undergo revision." (*Id.*) Subsequently, Nakos et al. found phospholipid antibodies were in GBS patients. (*Id.* (citing G. Nakos et al., *Anti-Phospholipid Antibodies in Serum from Patients with Guillain-Barré Syndrome*, 31 INTENSIVE CARE MED. 1401 (2005) (Ex. 142)).) In that study, four blood serum samples were obtained before and after treatment with γ-globulin. (*Id.* (quoting Nakos et al., *supra,* at Ex. 142, p. 1).) Researchers found that anti-phospholipid antibodies of the IgM, IgA, and IgG families were detected in the sera of all GBS patients studied and none of the controls. (*Id.* (quoting Nakos et al., *supra,* at Ex. 142, p. 1).) Phosphatidylinositol, cardiolipin, phosphatidylcholine, and phosphatidic acid were the main antigens. (*Id.* (quoting Nakos et al., *supra,* at Ex. 142, p. 1).)

Dr. Steinman explains that phosphatidylserine is a glycerophospholipid that "consists of two fatty acids attached in ester linkage to the first and second carbon of glycerol and serine attached through a phosphodiester linkage to the third carbon of the glycerol." (Ex. 129, p. 8 (citing Nakos et al., *supra,* at Ex. 142).) "The glycerophosphate is on the third carbon in the glycerol bridge." (*Id.*) Citing Chang et al., Dr. Steinman indicates that the phosphoglycerol linkage is necessary "for immunogenicity of these capsular polysaccharides." (*Id.* at 9 (citing Janoi Chang et al., *Relevance of O-Acetyl and Phosphoglycerol Groups for the Antigenicity of* Streptococcus Pneumoniae *Serotype 18C Capsular Polysaccharide*, 30 VACCINE 7090 (2012) (Ex. 143)).) Chang et al. identified a complex structure in the repeating unit of serotype 18C in the Prevnar 13 vaccine, which has "a branched pentasaccharide with two apparently labile substituents: glycerol-phosphate and O-acetyl group." (*Id.* (quoting Chang et al., *supra*, at Ex. 143, p. 1.) The authors concluded that "[t]he loss of these groups may potentially reduce the ability of the 18C polysaccharide to induce the desired immune response." (*Id.* (quoting Chang et al., *supra*, at Ex. 143, p. 1).) Dr. Steinman concludes the phosphate head group on glycerophosphate is critical for the immunogenicity of the 18C component of Prevnar 13. (*Id.* at 10.) Dr. Steinman draws further support from the Prevnar 13 patent, which mentions glycerophosphate "in the embodiment of the invention." (*Id.* at 11.)

In addition to the Chang et al. paper emphasizing the need for phosphoglycerol in the immunogenicity of 18C, Dr. Steinman cites the work of Bryson et al., which demonstrates the human antibody response to CPS 23F. (Ex. 129, pp. 11-13 (citing Steve Bryson et al., *Structures of Preferred Human IgV Genes–Based Protective Antibodies Identify How Conserved Residues Contact Diverse Antigens and Assign Source of Specificity to CDR3 Loop Variation*, 196 J. IMMUNOLOGY 4723 (2016) (Ex. 146)).) Bryson et al. studied two antibodies directed to 23F from humans who were immunized with Pneumovax 23.[8] (*Id.* at 11-12 (citing Bryson et al., *supra,* at Ex. 146).) According to Dr. Steinman, the Bryson et al. study shows that phosphoglycerol is directly targeted by the core of the two human antibodies targeting 23F and that the phosphoglycerol in the polysaccharide capsule of serotype 23F is critical to the human immune response to serotype 23F. (*Id.* at 11-15 (citing Bryson et al., *supra,* at Ex. 146).) Dr. Steinman asserts that, because the 23F and 18C components of Prevnar 13 also contain the phosphoglycerol moiety that is targeted by the antibodies generated by Pneumovax 23, it is very likely that the immune response to the 23F and 18C components of Prevnar 13 also target the phosphoglycerol moiety. (*Id.* at 15 (citing *Prevnar 13 Prescribing Information* [hereinafter Prevnar 13 Package Insert], Ex. 140; Chang et al., supra, at Ex. 143).) He concludes, "[i]n my opinion, this is exceptionally 'close' to what I think would constitute 'certainty' on the question of whether humans who receive a pneumococcal vaccine make antibodies that target phosphoglycerol." (*Id.* at 16.)

[8] Although Dr. Steinman acknowledges that the Bryson study was performed with Pneumovax 23, he explains that, like the Prevnar 13 vaccine, the Pneumovax 23 vaccine contains the 18C and the 23F. (Ex. 129, pp. 12-13 (citing Bryson et al., *supra,* at Ex. 146).) Because a study has not yet been conducted using the Prevnar 13 vaccine, Dr. Steinman asserts that the Bryson et al. study "is the best the Petitioner can do at the present time." (*Id.* at 13 (citing Bryson et al., *supra,* at Ex. 146).)

The second area of molecular mimicry Dr. Steinman identifies occurs between CRM197 and an immunogenic protein carrier known as Contactin-1. (Ex. 129, p. 16.) Dr. Steinman explains that Contactin-1 is "targeted in some cases of GBS." (*Id.* (citing Yumako Miura et al., *Contactin I IgG4 Associates to Chronic Inflammatory Demyelinating Polyneuropathy with Sensory Ataxia*, 138 BRAIN 1484 (2015) (Ex. 150)).) In order to test the components of the Prevnar 13 vaccine, Dr. Steinman conducted BLAST searches[9] to align Contactin-1 with the components of CRM197 in the Prevnar 13 vaccine. (*Id.*) Dr. Steinman then submitted his BLAST results in the Immune Epitope Database (IEDB)[10] to determine whether other researchers have identified the epitope(s). (*Id.* at 22.) Dr. Steinman first tested the sequence WEQAKALSVE and determined that this sequence is both found on human immune cells and an epitope in diphtheria toxin, which has only one amino acid difference from CRM197. (*Id.* at 23.) Dr. Steinman tested a second sequence, EYMAQACAGNRVRR, which also has "known cross-reactivity with epitopes described in humans and on the c. diphtheria microbe that is the basis for CRM197." (*Id.* at 25 (citing Raghavanpillai Raju et al., *Epitopes for Human CD4+ Cells on Diphtheria Toxin: Structural Features of Sequence Segments Forming Epitopes Recognized by Most Subjects*, 25 EUR. J. IMMUNOLOGY 3207 (1995) (Ex. 159)).) These results, Dr. Steinman explains, demonstrate a compelling theory that molecular mimics in the Prevnar 13 vaccine, received by petitioner, "could trigger inflammatory neuropathy culminating in GBS." (*Id.* at 26.)

Dr. Steinman cites two case reports discussing the association of Prevnar 13 vaccination and GBS. (Ex. 129, p. 27.) The first report was of "a woman who developed bilateral lower extremity weakness from [GBS] a month after administration

[9] According to the NIH website, the Basic Local Alignment Search Tool (BLAST) "finds regions of local similarity between sequences" and "can be used to infer functional and evolutionary relationships between sequences as well as help identify members of gene families." *Basic Local Alignment Search Tool*, NAT'L LIBR. MED., https://blast.ncbi.nlm.nih.gov/Blast.cgi (last visited July 17, 2024). Dr. Steinman classifies his criteria for a molecular mimic as a run of at least 5 out of 12 amino acids that are identical. (Ex. 129, p. 16.) Based on his own published research, Dr. Steinman opines that the identity of 5 of 12 amino acids were sufficient to "trigger clinically relevant neuroinflammation with paralysis." (*Id.* (citing Anand Gautam et al., *A Polyalanine Peptide with Only Five Native Myelin Basic Protein Residues Induces Autoimmune Encephalomyelitis*, 127 J. EXPERIMENTAL MED. 605 (1992) (Ex. 151); Anand Gautam et al., *Minimum Structural Requirements for Peptide Presentation by Major Histocompatibility Complex Class II Molecules: Implications in Induction of Autoimmunity*, 91 PROC. NAT'L ACAD. SCIS. USA 767 (1994) (Ex. 152); Anand Gautam et al., *A Viral Peptide with Limited Homology to a Self Peptide Can Induce Clinical Signs of Experimental Autoimmune Encephalomyelitis*, 161 J. IMMUNOLOGY 60 (1998) (Ex. 153); Tobias V. Lanz et al., *Clonally Expanded B Cells in Multiple Sclerosis Bind EBV EBNA1 and GlialCAM*, 603 NATURE 321 (2022) (Ex. 154); William H. Robinson & Lawrence Steinman, *Epstein-Barr Virus and Multiple Sclerosis*, 375 SCIENCE 264 (2022) (Ex. 155); Kjetil Bjornevik et al., *Longitudinal Analysis Reveals High Prevalence of Epstein-Barr Virus Associated with Multiple Sclerosis*, 375 SCIENCE 296 (2022) (Ex. 156); Hartmut Wekerle, *Multiple sclerosis Sparked by Virus-Led Autoimmunity,* 603 NATURE 230 (2022) (Ex. 157)).) He also adds that the 5 out of 12 identical amino acids need not be consecutive. (*Id.*)

[10] The IEDB "catalogs experimental data on antibody and T cell epitopes studied in humans, non-human primates, and other animal species in the context of infectious disease, allergy, autoimmunity, and transplantation. The IEDB also hosts tools to assist in the prediction and analysis of epitopes." (Ex. 129, pp. 22-23 (citing IMMUNE EPITOPE DATABASE & TOOLS, https://www.iedb.org/home_v3.php (last visited July 17, 2024).)

of the PCV"—also cited by Dr. Sheikh. (*Id.* (citing Nidhi Ravishankar, *Guillain-Barre Syndrome Following PCV Vaccine*, 2 CLINICS SURGERY 1413 (2017) (Ex. 160)).) The second report was published in October 2016 by the CDC and describes eleven reports of GBS following Prevnar 13 vaccination. (*Id.* (citing Penina Haber et al., *Post-Licensure Surveillance of 13-Valent Pneumococcal Conjugate Vaccine (PCV13) in Adults Aged ≥ 19 Years Old in the United States, Vaccine Adverse Event Reporting System (VAERS), June 1, 2012 – December 31, 2015*, 34 VACCINE 6330 (2016) (Ex. 161)).) The median time range was nine days following vaccination; and the median age was sixty-eight years old. (*Id.*) The article reports only one individual had an upper respiratory infection sixteen days prior to GBS. (*Id.*)

In this case, Dr. Steinman observes that petitioner presented to his primary care provider at Southtowns Family Practice for a "Welcome to Medicare" visit on July 13, 2016, during which, the vaccination at issue in this case was administered. (Ex. 129, p. 27 (citing Ex. 2, p. 81, 85).) "On August 5, 2016, approximately three weeks later, [petitioner] presented to Mercy Hospital with acute upper back pain that had been continuing for two days." (*Id.* (citing Ex. 2, p. 274).) "At that time, he also complained of numbness in his hands and feet." (*Id.*) Dr. Steinman concludes the onset was in a time interval of approximately 3 weeks. (*Id.*) He agrees with Dr. Sheikh's opinion that petitioner's three-week onset was medically acceptable and consistent with the timing supported by Schonberger et al., an epidemiologic study concerning the 1976 swine flu vaccine and GBS, which he explains is often used as a "surrogate" in post-vaccination GBS cases. (*Id.* (citing Lawrence Schonberger et al., *Guillain-Barre Syndrome Following Vaccination in the National Influenza Immunization Program, United States, 1976-1977*, 110 AM. J. EPIDEMIOLOGY 105 (1979) (Ex. 162)).)

Responding to a critique by Dr. Kedl suggesting that phosphoglycerol is widespread in the body, Dr. Steinman's second report provides examples wherein certain "targets," or epitopes, are expressed in multiple tissues throughout the body, but still result in autoimmune disease without causing dysfunction at all other locations of antigen expression. (Ex. 163, pp. 4-5.) He explains that Aquaporin 4 (AQP4) is the target antigen in neuromyelitis optica (NMO); and AQP4 is expressed in the kidney, as well as in astrocytes lining the brain and within the brain and optic nerve itself. (*Id.*) Yet, patients with NMO do not also suffer renal disease, although AQP4 is expressed in the kidney. (*Id.*) He also points to the relationship between gangliosides and *C. jejuni*, noting that "an immune response to gangliosides found in [*C. jejuni*] only leads to GBS," despite the presence of gangliosides throughout the body. (*Id.* at 10.) Following this logic, Dr. Steinman suggests that the fact that phosphoglycerol is a widespread antigen would not discount the idea that it can induce an organ specific disease. (*Id.* at 4-5, 10, 19.)

Turning to Dr. Kedl's critique of the Nakos et al. article, Dr. Steinman stresses that data regarding IgG antibody levels in the article was listed as "data not shown." (Ex. 163, p. 7 (quoting Nakos et al., *supra,* at Ex. 142).) He suggests a transient increase in antibodies to phospholipids detected by the study could have been secondary to the process of responding to IVIg, and not due to contamination with anti-

phospholipid antibody in the IVIg preparation. (*Id.* at 7-8.) Moreover, not all patients who are administered IVIg for GBS respond, and not all patients who respond to the treatment respond immediately. (*Id.* at 8.) However, because the data is not shown, he suggests that the Nakos et al. article does "not tell us whether treatment with IVIg causing a transient rise in antibodies to phospholipids led to detrimental effects," and in fact, another study supports the safety of treating anti-phospholipid syndrome patients with IVIg. (*Id.* (citing Y. Sherer et al., *Antiphospholipid Antibody Levels in Intravenous Immunoglobulin (IVIg) Preparation*s, 10 LUPUS 568 (2001) (Ex. 173)).) Additionally, Dr. Steinman asserts that the adjuvanticity of alum, an adjuvant contained in the Prevnar 13 vaccine, "might heighten an anti-phospholipid immune response." (*Id.*) Dr. Steinman also defends his interpretation of the data from the Gilburd et al. study, explaining that the authors "had no way of knowing later research from Nakos, Chang, Bryson and the inventions in issued US patents concerning the key role of phosphoglycerol in the immune response to Prevnar 13 vaccine[.]" (*Id.* at 10 (citing Gilburd et al., *supra,* at Ex. 141; Nakos et al., *supra,* at Ex. 142; Chang et al., *supra,* at Ex. 143; Bryson et al., *supra,* at Ex. 146).)

b. Respondent's Experts

i. Ross M. Kedl, Ph.D.[11]

Respondent filed five expert reports from Dr. Kedl. (Exs. A, C, D, I, N.) Dr. Kedl opines that petitioner's GBS was more likely caused by his "coincident and consistent litany . . . of pre-vaccination medical maladies." (Ex. A, p. 9.) He notes that petitioner's pre-vaccination medical history was significant for obesity, hypertension, diabetes mellitus, hyperlipidemia, coronary artery disease, ischemic cardiomyopathy and congestive heart failure, paroxysmal atrial fibrillation, prostatic hypertrophy, venous insufficiency, peripheral vascular disease, GERD, and Vitamin B12 deficiency. (*Id.*) According to Dr. Kedl, "all of these conditions are indicative of a highly elevated inflammatory internal environment predisposing [petitioner] to a variety of pathologies." (*Id.*) He stresses "the inflammatory nature of adipose tissue . . . and its association with both type II diabetes and peripheral neuropathies." (*Id.* (citing Shannon M. Reilly & Alan

[11] Dr. Kedl received his Ph.D. in pathobiology from the University of Minnesota Medical School in 1997, before going on to complete a postdoctoral fellowship at the Howard Hughes Medical Institute in 2001. (Ex. B, p. 1.) After completing his postdoctoral fellowship, Dr. Kedl worked as a senior immunologist in the Immune Response Modifier program at 3M Pharmaceuticals. (*Id.* at 2; Ex. A, pp. 1-2.) In that capacity, his work focused on "the design, development, and mechanisms of action of small TLR7/8 agonists." (Ex. A, p. 2.) He currently works as a professor in the Department of Immunology and Microbiology at the University of Colorado. (*Id.* at 1; Ex. B, p. 2.) Since joining the faculty at the University of Colorado in 2004, Dr. Kedl has maintained an NIH funded research program that has focused on "the biology of vaccine adjuvants and their capacity to induce robust and enduring cellular immunity." (Ex. A, p. 1; Ex. B, pp. 10-11.) He has also participated in NIH funded projects concerning "the study of antigen inexperienced T cell subsets as well as . . . the role of lymphatic endothelial cells in the management of T cell memory after vaccination or viral challenge." (Ex. A, p. 1.) Dr. Kedl has published over 65 peer-reviewed articles, 2 book chapters, and 13 invited reviews and commentaries. (Ex. B, pp. 11-17.) He has "more than 20 years of experience (incorporating both academic and industry perspectives) in evaluating the influence of vaccine adjuvants on the induction of local and systemic inflammation and its eventual induction of downstream adaptive immunity." (Ex. A, p. 2.)

R. Saltiel, *Adapting to Obesity with Adipose Tissue Inflammation*, 13 NATURE REVS.: ENDOCRINOLOGY 633 (2017) (Ex. A, Tab 22); Rens Hanewinckel et al., *The Epidemiology and Risk Factors of Chronic Polyneuropathy*, 31 EUR. J. EPIDEMIOLOGY 5 (2016) (Ex. A, Tab 9)).) Moreover, obesity alters the microbiota in the host and increases susceptibility to infection with *C. jejuni* infection. (*Id.* (citing S. Bereswill et al., *What You Eat Is What You Get: Novel* Campylobacter *Models in the Quadrangle Relationship Between Nutrition, Obesity, Microbiota, and Susceptibility to Infection*, 1 EUR. J. MICROBIOLOGY & IMMUNOLOGY 237 (2011) (Ex. A, Tab 2)).) Commensurate with the development of symptoms and suspected diagnosis of GBS, Dr. Kedl notes that petitioner had repeated demonstrations of elevated white blood cell count / neutrophilia and dysregulated blood chemistry. (*Id.* (citing Ex. 16, pp. 663-65).) "This is indicative of a concomitant subclinical infection that [petitioner's] physicians or expert failed to notice[,]" which Dr. Kedl explains is not unusual because only a minority of patients experience symptoms in response to the infections commonly associated with GBS. (*Id.* (citing Koga et al., *supra,* at Ex. A, Tab 14); Ex. C, p. 4.) Moreover, he suggests that petitioner's elevated neutrophil count during the course of IVIg treatment is further evidence of an ongoing infection because IVIg treatment typically results in a decrease in neutrophil count within a few days after treatment initiation. (*Id.*) Because GBS is frequently preceded by infection, Dr. Kedl concludes that infection is a far more likely cause of petitioner's neurological complications. (*Id.* at 10.)

Dr. Kedl opines that "molecular mimicry is questionable as a relevant mechanism of neuronal injury." (Ex. A, p. 4.) He notes that Dr. Sheikh relies on data demonstrating a relationship between post-infectious (not post-vaccination) anti-gangliosides. (Ex. C, p. 5.) Moreover, Dr. Kedl stresses that the causal relationship between ganglioside-specific antibodies and GBS is poorly linked as it is found in only a small minority (20-30%) of GBS patients. (Ex. A, p. 5 (citing Maksimiljan Gorenjac, *Clinical and Diagnostic Role of Ganglioside Antibody Testing*, 15 J. INT'L FED'N CLINICAL CHEMISTRY & LAB'Y MED. 95 (2004) (Ex. A, Tab 6); Koga et al., *supra*, at Ex. A, Tab 14); *see also* Adi Hersalis Eldar & Joab Chapman, *Guillain Barré Syndrome and Other Immune Mediated Neuropathies: Diagnosis and Classification*, 13 AUTOIMMUNITY REVS. 525, 526 (2014) (Ex. A, Tab 5, p. 2) (noting "the majority of GBS patients (AIDP subtype) have no identified autoantibodies so the pathogenesis of the disease is still debated.").) Moreover, Dr. Kedl maintains that reports of experimentally induced ganglioside specific antibody mediated pathology (as a result of ganglioside immunization) are "misleading and contradictory." (Ex. A, p. 5.) He takes issue with the fact that these studies are performed with repeated immunizations of large amounts of gangliosides emulsified in heat killed mycobacteria and mineral oil, *i.e.*, Complete Freund's Adjuvant, which is highly inflammatory. (*Id.* (citing Tyrone Bowes et al., *Tolerance to Self Gangliosides is the Major Factor Restricting the Antibody Response to Lipopolysaccharide Core Oligosaccharides in* Campylobacter jejuni *Strains Associated with Guillain-Barré Syndrome*, 70 INFECTION & IMMUNITY 5008 (2002) (Ex. A, Tab 3); A.L. Moyano et al., *Validation of a Rabbit Model of Neuropathy Induced by Immunization with Gangliosides*, 272 J. NEUROLOGICAL SCIS. 110 (2008) (Ex. A, Tab 21); Nobuhiro Yuki et al., *Carbohydrate Mimicry Between Human Ganglioside GM1 and* Campylobacter jejuni *Lipooligosaccharide Causes Guillain-Barré Syndrome*, 101 PROC. NAT'L ACAD. SCIS.

11404 (2004) (Ex. A, Tab 27)); Ex. C, pp. 6-7.) Additionally, Dr. Kedl emphasizes that the "outrageously toxic mixture" used to induce GBS-like symptoms in the animal models cited by Dr. Sheikh cannot be used to interpret what a clinical vaccine preparation may or may not do simply because both happen to be injected. (Ex. C, p. 7.) He further notes that, even when utilizing this "overwhelmingly inflammatory formulation," studies have still found induction of GBS-like symptoms to be variable or nonexistent. (Ex. A, p. 5 (citing Somsankar Dasgupta et al., *Lack of Apparent Neurological Abnormalities in Rabbits Sensitized by Gangliosides,* 29 NEUROCHEMICAL RSCH 2147 (2004) (Ex. A, Tab 4)).)

Dr. Kedl stresses that "antibodies against self-antigens can be found in all healthy individuals." (Ex. A, p. 6 (citing Vincent Hurez et al., *Expression and Control of the Natural Autoreactive IgG Repertoire in Normal Human Serum*, 23 EUR. J. IMMUNOLOGY 783 (1993) (Ex. A, Tab 11); L. Mouthon et al., *Analysis of the Normal Human IgG Antibody Repertoire: Evidence that IgG Autoantibodies of Healthy Adults Recognize a Limited and Conserved Set of Protein Antigens in Homologous Tissues*, 154 J. IMMUNOLOGY 5769 (1995) (Ex. A, Tab 20)); *see also* Ex. C, p. 5; Ex. D, pp. 5-6.) Thus, simply identifying autoantibodies does not indicate autoimmunity. (Ex. A, p. 6; Ex. C, p. 5; Ex. D, p. 5.) Further, Dr. Kedl opines that "repeated vaccination often induces cross reactivity with no corresponding impact on autoimmune pathology." (Ex. A, p. 6.) As an example, he highlights the broadly neutralizing antibodies against HIV. (*Id.*) Dr. Kedl explains that HIV-specific broadly neutralizing antibodies are "rare and a handful have been studied in an attempt to understand what endows them with their capacity to neutralize HIV across numerous strains and clades." (*Id.*) Besides targeting HIV surface proteins, he notes that they are also often highly cross reactive with numerous self-antigens. (*Id.* (citing Laurent Verkoczy & Marilyn Diaz, *Autoreactivity in HIV-1 Broadly Neutralizing Antibodies: Implications for Their Function and Induction by Vaccination*, 9 CURRENT OP.: HIV & AIDS 224 (2014) (Ex. A, Tab 26); Barton F. Haynes et al., *Cardiolipin Polyspecific Autoreactivity in Two Broadly Neutralizing HIV-1 Antibodies*, 308 SCIENCE 1906 (2005) (Ex. A, Tab 10)).) According to Dr. Kedl, "[t]his self-reactivity actually assists in HIV neutralization without any obvious autoimmune complications." (*Id.* (citing Haynes et al., *supra*, at Ex. A, Tab 10; John R. Mascola & Barton F. Haynes, *HIV-1 Neutralizing Antibodies: Understanding Nature's Pathways*, 254 IMMUNOLOGICAL REVS. 225 (2013) (Ex. A, Tab 18)).) This, he contends, reinforces the point that auto-reactivity does not alone equate with pathology. (*Id.*)

Dr. Kedl opines that there is no relationship between pneumococcal vaccination and autoantibody formation or autoimmunity. (Ex. A, pp. 7-9.) He contends that attempts at vaccine-induced neuropathology are "highly variable with documented failures questioning the entire concept of oligosaccharide/ganglioside molecular mimicry as a legitimate etiology for GBS." (*Id.* at 7.) Even studies that induced neuropathology could do so only under "excessive and chronic inflammatory conditions." (*Id.* (citing Bowes et al., *supra*, at Ex. A, Tab 3; Moyano et al., *supra*, at Ex. A, Tab 21; Yuki et al., *supra*, at Ex. A, Tab 27).) Nor does epidemiological data on the use of the Prevnar vaccine bear out any connection to chronic autoimmune conditions, including GBS. (*Id.* at 8.) Dr. Kedl criticizes the case reports cited by Dr. Sheikh, noting that case reports

"generally presuppose that a preceding event is a precipitating event" and are therefore "built around coincidence." (*Id.*) He opines that the available epidemiological data, including the data cited by Dr. Sheikh (Catherine Cordonnier et al., *Immunogenicity, Safety, and Tolerability of 13-Valent Pneumococcal Conjugate Vaccine Followed by 23-Valent Pneumococcal Polysaccharide Vaccine in Recipients of Allogeneic Hematopoietic Stem Cell Transplant Aged ≥ 2 Years: An Open-Label Study,* 61 CLINICAL INFECTIOUS DIS. 313 (2015) (Ex. 36); Haber et al., *supra,* at Ex. 161; T.F. Schwarz et al., *A Randomized, Double-Blind Trial to Evaluate Immunogenicity and Safety of 13-Valent Pneumococcal Conjugate Vaccine Given Concomitantly with Trivalent Influenza Vaccine in Adults Aged ≥ 65 Years,* 29 VACCINE 5195 (2011) (Ex. 38); Ravishankar, *supra,* at Ex. 160), have failed to document even a single case of GBS after Prevnar 13 vaccination, despite taking into account more than 60,000 vaccine doses. (Ex. A, p. 8 (citing Lisa A. Jackson et al., *Immunogenicity and Safety of a 13-Valent Pneumococcal Conjugate Vaccine in Adults 70 Years of Age and Older Previously Vaccinated with 23-Valent Pneumococcal Polysaccharide Vaccine*, 31 VACCINE 3585 (2013) (Ex. A, Tab 12); Lisa A. Jackson et al., *Immunogenicity and Safety of a 13-Valent Pneumococcal Conjugate Vaccine Compared to a 23-Valent Pneumococcal Polysaccharide Vaccine in Pneumococcal Vaccine-Naive Adults*, 31 VACCINE 3577 (2013) (Ex. A, Tab 13)).)

Dr. Kedl opines that Dr. Steinman's phospholipid-based mimicry is unsound because "phospholipids are ubiquitous in human tissue and not unique to myelin." (Ex. I, p. 3.) He stresses that all membranes of all cells in the body consist of phospholipids – including phosphatidyl-ethanolamine, phosphatidyl-choline, and phosphatidylserine. (*Id.*) Dr. Kedl explains that all three lipids are components of the outer (phosphatidyl-ethanolamine and phosphatidyl-choline) and inner (phosphatidylserine and phosphatidyl-ethanolamine) cell surface membranes in every cell of the body. (*Id.*) Therefore, he insists that "there is no reliable reason why antibodies would choose to preferentially target the phosphoglycerol lipids in the myelin sheath of peripheral nerves for pathogenesis and not in every other cell in the body." (*Id.*) Similarly confounding, Dr. Kedl opines that IVIg contains antibodies specific for numerous phospholipids. (*Id.* (citing Ilan Krause et al., *Anti-DNA and Antiphospholipid Antibodies in IVIG Preparations:* In Vivo *Study in Naive Mice*, 18 J. CLINICAL IMMUNOLOGY 52 (1998) (Ex. I, Tab 1)).) He insists the amount of anti-phospholipid activity in IVIg treated patients actually increases immediately following infusion. (*Id.* at 3-4 (citing Nakos et al., *supra*, at Ex. 142).)

Although the therapeutic underpinnings of IVIg are not completely understood, Dr. Kedl opines that high amounts of phospholipid-specific antibodies in IVIg more likely supports a therapeutic role for these antibodies and, given that phospholipid reactivity does not serve as a barrier to IVIg's therapeutic efficacy against autoimmune complications, "it is inconceivable how it can automatically equate with autoimmune pathology." (Ex. I, pp. 4-5.) This, he explains, is precisely what the authors concluded in Gilburd et al. (*Id.* at 5 (citing Gilburd et al., *supra,* at 141.) Dr. Kedl suggests the Gilburd et al. study's conclusion regarding the presence of anti-phospholipid antibodies in GBS patients does not need revision. (*Id.*) Gilburd et al. concluded that the antiphospholipid antibodies they found in GBS patients were probably "produced as a

result of the myelin damage, rather than caused by the inflammatory demyelination." (*Id.* (quoting Gilburd et al., *supra,* at Ex. 141, p. 6).) Dr. Kedl suggests the available data confirms this conclusion. (*Id.*) He explains the presence of phospholipid-specific antibodies "may assist in the clearance of cellular debris that can instigate further detrimental inflammatory processes." (*Id.* at 4.) Under normal conditions, phosphatidylserines are sequestered away from the extracellular environment; but during apoptosis, phosphatidylserine "is flipped from the inner to the outer membrane where it can be recognized by specific receptors found on scavenger cells whose job it is to clear the system of dying cells and cellular debris." (*Id.* at 5.) "These scavenger cells also have receptors for the tail end of antibodies to help facilitate similar clearance of antibody-bound viruses and bacteria." (*Id.*) Dr. Kedl explains that phosphatidylserine-specific antibodies may also assist in this process by binding to cellular debris that may promote inflammation and disrupt local tissue function, like what is seen in peripheral nerves during GBS. (*Id.*) Dr. Kedl opines that this could clarify any association of these antibodies with the onset of autoimmunity as "a harbinger, not an executioner of tissue dysfunction." (*Id.*)

Dr. Kedl also opines that Dr. Steinman's theory of vaccine causation by molecular mimicry between CRM197 and contactin-1 is unpersuasive. (Ex. I, pp. 6-8.) He indicates the E-values for the similarities between CRM197 and contactin-1 are almost 2 orders of magnitude higher than the search engine's default value (0.05).[12] (*Id.* at 6.) He also criticizes Dr. Steinman for comparing CRM197 to contactin-1, rather than "BLASTing" the sequence of CRM197 against the entire genome. (*Id.* at 6-7.) Dr. Kedl suggests this choice was made because Dr. Steinman believes this is a neuron specific protein. (*Id.* at 6.) Yet, Dr. Kedl insists that contactin-1 expression is not isolated to nervous tissue. (*Id.*) For petitioner to have generated an immune response with meaningful cross reactivity to contactin-1, Dr. Steinman must also to explain why petitioner did not then experience any circulatory symptoms. (*Id.*) Additionally, Dr. Kedl opines that the 5 out of 10 similarity between the CRM197 epitope (WEQAKALSVE) and contactin-1 is insignificant. (*Id.* at 6-7.) In order for the 5 out of 10 similarity to be significant, Dr. Kedl suggests that Dr Steinman must believe that contactin-1 is the only protein across the human genome that has this level of similarity with this short sequence from CRM197. (*Id.*) Following this logic, Dr. Kedl declares if more proteins in the human genome could be identified with the same or better similarity to this epitope,

[12] Because CRM197 had also been referenced by petitioner's experts prior to Dr. Steinman's entry in the case, this was also previously discussed by Dr. Kedl. In an earlier report, Dr. Kedl opines that the literature purporting to demonstrate peptide sequence similarity between CRM197 and myelin P0 are "pure speculation." (Ex. D, p. 3.) He contends that there is no basis in experimentation for this theory; and the conclusions of the authors are questionable, given the E-value of the regions of similarity identified in the BLAST results. (*Id.*) In that context, Dr. Kedl explains that the BLAST search itself has a "built-in statistical metric," the E-value, which is designed to inform whether similarities identified within the search results have a chance of being "anything more than random." (*Id.*) Silvanovich et al. concluded that any E-value greater than 0.00000039 reflects a similarity that is "more than likely irrelevant." (*Id.* (citing Andre Silvanovich et al., *The Use of* E-*Scores to Determine the Quality of Protein Alignments*, 54 REGUL. TOXICOLOGY & PHARMACOLOGY S26 (2009) (Supp. Oct. 23-25, 2007) (Ex. D, Tab 4)).) Dr. Kedl notes "the E-values of any similarities between CRM197 and Myelin P0 fall above this cutoff by many orders of magnitude . . . rendering them meaningless." (*Id.* (citing Ex. D, app. A at 10-15).)

"then once again Dr. Steinman would be left to provide a valid scientific rationale for the immune systems' curious obsession with CNTN1 over and above all other targets that are as good if not better." (*Id.* at 7.) In fact, Dr. Kedl performed a BLAST search against the entire catalog of predicted human proteins encoded in the genome and found more than 3000 sequences identified with similar, "if not better," homology to WEQAKALSVE than contactin-1. (*Id.*)

Collectively, Dr. Kedl opines that these shortcomings "contradict all underlying assumptions of molecular mimicry as a model, failing to meet the demands of *Althen* prong one for identifying a persuasive and medically reliable theory of vaccine causation." (Ex. I, p. 8.)

ii. Brian C. Callaghan, M.D., M.S.[13]

Respondent filed one expert report from Dr. Callaghan. (Ex. G.) Dr. Callaghan opines that petitioner likely developed GBS 22 days after his Prevnar 13 vaccination. (*Id.* at 3.) He added that:

> While Dr. Chaudhry believed the GBS diagnosis was questionable due to the lack of confirmatory testing and application of the Brighton criteria, in this particular case, petitioner's history, examination, treatment response, and subsequent clinical course are all consistent with a diagnosis of GBS. Lumbar puncture and electrodiagnostic testing were not performed, but GBS remains the most likely diagnosis.

(*Id.*) However, he maintains that there is no convincing evidence to support a causal association with Prevnar vaccination and GBS. (*Id.*)

Dr. Callaghan cites the Haber et al. study where "the authors performed a data mining analysis that did not reveal more cases of GBS than would be expected in the general population and did not identify any new or unexpected [adverse events]." (Ex. G, p. 3 (citing Haber et al., *supra*, at Ex. 161).) "Specifically, the authors applied empirical Bayesian data mining methods to identify disproportionality of vaccine-adverse event pairs stratified by age group, sex, and by the year the reports were

[13] Dr. Callaghan received his medical degree from the University of Pennsylvania Medical Center in Philadelphia, Pennsylvania, before going on to complete an internship in preliminary medicine and a residency in neurology at the same university. (Ex. H, p. 1.) He completed a neuromuscular fellowship and a fellowship in the Center of Healthcare Research and Transformation Policy at the University of Michigan Health System in Ann Arbor, Michigan, and then went on to receive a master's degree in clinical research design and statistical analysis from the same university. (*Id.*) Dr. Callaghan is board certified in psychiatry and neurology, and electrodiagnostic medicine. (*Id.*; Ex. G, p. 1.) He maintains a medical license and a controlled substance license in Michigan. (Ex. H, p. 1.) He currently works as an associate professor of neurology at the University of Michigan Health System and a staff physician in the Department of Neurology at the VA Ann Arbor Health System. (*Id.* at 1-2; Ex. G, p. 1.) He is a neuromuscular specialist with an interest in patients with neuropathies, and he has seen an estimated 50 patients with GBS. (Ex. G, p. 1.) He has also published over 120 peer-reviewed articles, abstracts, and book chapter, mostly focusing on neuropathies, and including appropriate diagnostic evaluation and treatment of such. (*Id.*; Ex. H, pp. 10-17.)

received." (*Id.* (citing Haber et al., *supra*, at Ex. 161).) "While GBS was not seen more than expected in the general population, vaccination site cellulitis, local reaction, skin reaction, and skin swelling were all found to be more common than expected." (*Id.* (citing Haber et al., *supra*, at Ex. 161).) Dr. Callaghan suggests that this analytic approach therefore can identify vaccine complications. (*Id.*) Petitioner's experts provide 2 case reports of GBS after Prevnar vaccination. (*Id.*) Dr. Callaghan stresses, however, that "case reports only demonstrate a proximal temporal relationship between Prevnar vaccination and GBS." (*Id.*) Accordingly, he notes that "a proximate temporal relationship alone is insufficient to show causation." (*Id.*)

Dr. Callaghan contends that Dr. Sheikh provides no data specific to the Prevnar vaccine for any of his proposed mechanisms. (Ex. G, p. 4.) By providing seven possible mechanisms, Dr. Callaghan insists that it is clear that there is no mechanism with convincing evidence to support Prevnar vaccination leading to GBS. (*Id.*) In response to the Vardhini et al. article cited by petitioner, Dr. Callaghan stresses that the study sought to identify mechanisms by which mycobacterium leprae cause nerve injury and not for Prevnar vaccination to cause GBS. (*Id.* (citing Vardhini et al., *Comparative Proteomics of the* Mycobacterium leprae *Binding Protein Myelin P0: Its Implication in Leprosy and Other Neurodegenerative Diseases,* 4 INFECTION, GENETICS, & EVOLUTION 21 (2004) (Ex. 48)).) Petitioner's expert suggests that petitioner's genetic uniqueness led to Prevnar being able to cause GBS, but Dr. Callaghan notes there is no data about the petitioner's genetics that could have led to his GBS. (*Id.*) Petitioner's expert opines that "there are four criteria for molecular mimicry, but that these should not be the standard for demonstrating this phenomenon." (*Id.*) Dr. Callaghan opines the Prevnar vaccination does not meet any of these four criteria. (*Id.*) Nor does petitioner's expert provide a sound rationale for the use of other criteria. (*Id.*) Dr. Callaghan agrees with respondent's experts, Drs. Chaudhry and Kedl, "that there is no evidence of a biologic mechanism more likely than not linking Prevnar vaccination to GBS either provided by petitioner's experts or in the medical literature. (*Id.*) He concludes "petitioner likely suffered from GBS, but the cause in unclear." (*Id.*)

V. Discussion

a. *Althen* prong one

Under *Althen* prong one, petitioner must provide a "reputable medical theory," showing that the subject vaccine can cause the type of injury alleged. *Pafford ex rel. Pafford v. Sec'y of Health & Human Servs.*, 451 F.3d 1352, 1355-56 (Fed. Cir. 2006) (quoting *Pafford v. Sec'y of Health & Human Servs.*, No. 01-0165V, 2004 WL 1717359, at *4 (Fed. Cl. Spec. Mstr. July 16, 2004)). Such a theory need only be "legally probable, not medically or scientifically certain." *Knudsen,* 35 F.3d at 548-49. Petitioner may satisfy the first *Althen* prong without resort to medical literature, epidemiological studies, demonstration of a specific mechanism, or a generally accepted medical theory. *See Andreu ex rel. Andreu v. Sec'y of Health & Human Servs.*, 569 F.3d 1367, 1378-79 (Fed. Cir. 2009) (citing *Capizzano v. Sec'y of Health & Human Servs.*, 440 F.3d 1317, 1325-26 (Fed. Cir. 2006)). However, "[a] petitioner must provide a

'reputable medical or scientific explanation' for [the proposed causal] theory. While it does not require medical or scientific certainty, it must still be 'sound and reliable.'" *Boatmon*, 941 F.3d at 1359 (quoting *Knudsen*, 35 F.3d at 548-49).

As with many cases in the Program, petitioner's theory involves molecular mimicry. Molecular mimicry is a concept with several constituent parts whereby (1) a susceptible host (2) encounters a foreign antigen that has sufficient similarity ("homology") with components of host tissue such that (3) the immune system "cross reacts," producing antibodies that attack the host tissue instead of the foreign antigen to (4) ultimately cause disease or injury. (INST. OF MED., ADVERSE EFFECTS OF VACCINES: EVIDENCE AND CAUSALITY (2012) [hereinafter IOM 2012 Report] (Ex. E, Tab 12, p. 10); Robert S. Fujinami et al., *Molecular Mimicry, Bystander Activation, or Viral Persistence: Infections and Autoimmune Disease*, 19 CLINICAL MICROBIOLOGY REVS. 80 (2006) (Ex. 166).) Molecular mimicry "is a generally accepted scientific principle, [but] mere invocation of the scientific term does not carry a petitioner's burden in a Program case." *Deshler v. Sec'y of Health & Human Servs.*, No. 16-1070V, 2020 WL 4593162, at *20 (Fed. Cl. Spec. Mstr. July 1, 2020) (citing *Forrest v. Sec'y of Health & Human Servs.*, No. 14-1046V, 2019 WL 925495, at *3 (Fed. Cl. Spec. Mstr. Jan. 18, 2019)). This is because "the finding of sequence homology does not necessarily mean the similarity has significance to the immune system." *Tullio v. Sec'y of Health & Human Servs.*, No. 15-51V, 2019 WL 7580149, at *15 (Fed. Cl. Spec. Mstr. Dec. 19, 2019), *aff'd*, 149 Fed. Cl. 448 (2020); *see also Caredio ex rel. D.C. v. Sec'y of Health & Human Servs.*, No. 17-0079V, 2021 WL 4100294, at *31 (Fed. Cl. Spec. Mstr. July 30, 2021) ("*[D]emonstration of homology alone is not enough to establish a preponderant causation theory.*") (citing *Schultz v. Sec'y of Health & Human Servs.*, No. 16-539V, 2020 WL 1039161, at *22 n.24 (Fed. Cl. Spec. Mstr. Jan. 24, 2020))), *mot. for rev. den'd*, No. 17-79V, 2021 WL 6058835 (Fed. Cl. Dec. 3, 2021). However, as noted above, petitioners in this program are not required to establish scientific certainty. Therefore, prior cases have expressed with regard to the application of molecular mimicry that "[t]he line must be drawn somewhere between speculation and certainty." *Brayboy v. Sec'y of Health & Human Servs.*, No. 15-183V, 2021 WL 4453146, at *19 (Fed. Cl. Spec. Mstr. Aug. 30, 2021). Thus, for example, in *Brayboy*, an omnibus proceeding addressing autoimmune premature ovarian insufficiency, the special master found it sufficient that the petitioners "identified cross-reaction between components of the vaccine and proteins in the body that are directly responsible for the health and productivity of the organ at issue" and further expressed that requiring additional steps, or insisting on direct, testable evidence, would impermissibly heighten petitioners' burden of proof. *Id.*

GBS is an acute inflammatory polyneuropathy affecting the peripheral nerves and, in the case of AIDP, most notably affecting myelin tissue. (Ex. 68, p. 3.) While the condition is believed to be of an autoimmune etiology, the pathogenesis of GBS is incompletely understood. (Nakos et al., *supra*, at Ex. 142; Gilburd et al., *supra*, at Ex. 141; Ex. 18, p. 7.) Petitioner's experts opine that the current understanding of GBS provides some basic support for their opinion that the Prevnar 13 vaccine can cause GBS. (*See* Ex. 80, p. 5; Ex. 106, pp. 4-5; Ex. 129, pp. 27-28.) Although there is no

established association between *Streptococcus pneumonia* and GBS (Ex. E, pp. 15, 17-18), it is generally accepted that a number of different infectious antigens can cause GBS, including unspecified upper respiratory infections (Ex. 18, p. 4; Ex. E, pp. 13, 15; NAT'L INST. OF NEUROLOGICAL DISORDERS & STROKES, NAT'L INST. HEALTH, GUILLAIN-BARRÉ SYNDROME FACT SHEET (2020) (Ex. 138); B.C. Jacobs et al., *The Spectrum of Antecedent Infections in Guillain-Barré Syndrome: A Case-Control Study*, 51 NEUROLOGY 1110 (1998) (Ex. 20)). This includes both viral and bacterial infections. (Ex. 18, p. 4; Bianca van der Berg et al., *Guillain-Barré Syndrome Associated with Preceding Hepatitis E Virus Infection*, 82 NEUROLOGY 491 (2012) (Ex. 21).) Additionally, for at least one of these antigens, *C. jejuni*, there is sufficient proof to conclude that molecular mimicry is the mechanism of causation leading to GBS, albeit resulting primarily in the axonal subtype of GBS and involving a molecular mimic not at issue here. (Ex. 163, p. 5; Ex. E, p. 15; Nobuhiro Yuki, *Guillain-Barré Syndrome and Anti-Ganglioside Antibodies: A Clinician-Scientist's Journey*, 88 PROC. JAPAN ACAD.: SERIES B 299 (2012) (Ex. 169).) Evidence also supports homology between various other antigens and myelin tissue. (*See* IOM 2012 Report, *supra*, at Ex. E, Tab 12, p. 11 (hepatitis B virus); Richard A.C. Hughes & Jeremy H. Rees, *Clinical and Epidemiologic Features of Guillain-Barré Syndrome*, 176 J. INFECTIOUS DISEASES S92, S94 (Supp. 1997) (Ex. 53, p. 3) ("There is no doubt that rabies vaccines produced in nervous system tissue carried a risk of inducing GBS, which can readily be explained as being caused by immunization with myelin antigens.").) In that regard, there is little question that multiple antigens are implicated as causes of GBS. Additionally, respondent's expert agrees that at least some formulations of the flu vaccine have been identified as a cause of GBS. (Ex. G, p. 3.) Without equating the flu vaccine and the Prevnar 13 vaccine, petitioner's experts opine that, broadly speaking, this demonstrates that the immune response to vaccination, and not only active infection, is sufficient to cause GBS. (Ex. 129, p. 6.)

In some prior cases, this background information has partly informed the special masters' analysis of a petitioner's theory of causation with respect to GBS. *See, e.g.*, *J.G. v. Sec'y of Health & Human Servs.*, No. 20-664V, 2023 WL 2752634, at *30 (Fed. Cl. Spec. Mstr. Feb. 13, 2023) (observing that "[t]he experts do not dispute the theory of molecular mimicry, or that it is a sound and reliable theory generally as it relates to GBS" and that "[m]olecular mimicry has been accepted as a sound and reliable theory in many Vaccine Program cases dealing with demyelinating conditions, including GBS"); *Osso v. Sec'y of Health & Human Servs.*, No. 18-575V, 2023 WL 5016473, at *21 (Fed. Cl. Spec. Mstr. July 13, 2023) (molecular mimicry accepted as a "sound and reliable theory"); *Harris v. Sec'y of Health & Human Servs.*, No. 18-944V, 2023 WL 2583393, at *22 (Fed. Cl. Spec. Mstr. Feb. 21, 2023) (finding that "the fact that GBS is well accepted as an autoimmune condition with a wide variety of suspected antigenic triggers, inclusive of antigens from both infection and vaccination, provides meaningful evidence supporting petitioner's burden of proof with respect to *Althen* prong one"). *But see Trollinger v. Sec'y of Health & Human Servs.*, No. 16-473V, 2023 WL 2521912, at *30 (Fed. Cl. Spec. Mstr. Feb. 17, 2023) (finding that "Dr. Steinman's theory had a one-size-fits-all quality, in which he strained to shoehorn the science behind the flu-GBS association into the context of the pneumococcal vaccine" and further noting that, "[i]f

this were sufficient to establish that this particular vaccine 'can cause' GBS, it is hard to imagine the theory not also applying to *each and every one* of the sixteen Program-covered vaccines/vaccine antigenic components"), *mot. for rev. den'd*, 167 Fed. Cl. 127 (2023). Although only the flu vaccine is presumed to be a cause of GBS in this program (42 C.F.R. § 100.3(a)), petitioners have been found entitled to compensation in at least isolated instances for GBS caused by many other vaccines. This includes vaccines that target both viruses and bacteria. *See, e.g.*, *Salmins v. Sec'y of Health & Human Servs.*, No. 11-140V, 2014 WL 1569478, at *14 (Fed. Cl. Spec. Mstr. Mar. 31, 2014) (finding that HPV vaccine "can cause" GBS); *Peugh v. Sec'y of Health and Human Servs.*, No. 99-638V, 2007 WL 1531666, at *17 (Fed. Cl. Spec. Mstr. May 8, 2007) (finding as part of an omnibus proceeding that hepatitis B vaccine can GBS); *Whitener v. Sec'y of Health & Human Servs.*, No. 06-0477V, 2009 WL 3007380, at *20 (Fed. Cl. Spec. Mstr. Sept. 2, 2009) (finding that meningococcal vaccine can cause GBS); *Koller v. Sec'y of Health & Human Servs.*, No. 16-439V, 2021 WL 5027947, at *7-20 (Fed. Cl. Spec. Mstr. Oct. 8, 2021) (finding that pneumococcal conjugate vaccine, Prevnar 13, can cause GBS); *Mohamad v. Sec'y of Health & Human Servs*., No. 16-1075V, 2022 WL 711604, at *9-18 (Fed. Cl. Spec. Mstr. Jan. 27, 2022) (finding that Tdap vaccine can cause GBS); *J.G.*, 2023 WL 2752634, at *29-32 (finding that hepatitis A vaccine can cause GBS). In fact, given the nature of the condition, molecular mimicry has been accepted as a theory of causation for GBS even in the absence of *any* demonstration of homology and cross-reaction. *Salmins*, 2014 WL 1569478, at *14.

Within that context, Dr. Steinman opines that the Prevnar 13 vaccine can be considered among the many other causes of GBS, presenting several pieces of medical literature to demonstrate that (1) the Prevnar 13 vaccine contains phosphoglycerol groups that are necessary to the vaccine's immunogenicity (Ex. 129, pp. 7, 9-16 (citing Chang et al., *supra*, at Ex. 143; Prevnar 13 Package Insert, *supra,* at Ex. 140; Bryson et al., *supra*, at Ex. 146)); (2) the phosphate portion of the phospholipid molecule has immune reactivity in myelin tissue, albeit with regard to a different demyelinating condition (multiple sclerosis) (*Id.* at 7 (citing Ho et al., *supra*, at Ex. 136)); (3) GBS patients develop anti-phospholipid antibodies (*Id.* at 7-8 (citing Nakos et al., *supra*, at Ex. 142; Gilburd et al., *supra*, at Ex. 141)), and (4) these antibodies are cross-reactive with phospholipids present in myelin tissue (*Id.* (citing Gilburd et al., *supra*, at Ex. 141)). Dr. Steinman's theory does not involve the anti-ganglioside antibodies that are most commonly associated with GBS. However, literature filed in this case indicates that less than half of GBS patients have anti-ganglioside antibodies. (Gorenjac, *supra*, at Ex. A, Tab 6, p. 1; Koga et al., *supra*, at Ex. A, Tab 14, p. 6 tbl.2.) Moreover, on this record, respondent's expert, Dr. Kedl, stresses that the association between anti-ganglioside antibodies and GBS remains clinically unproven. (Ex. A, p. 6.) Thus, we do not actually know the full scope of the antibodies that may be implicated in the pathology of GBS, leaving little reason to doubt Dr. Steinman's theory on that basis. (*See, e.g.*, Christiaan Fokke et al., *Diagnosis of Guillain-Barré Sydnrome and Validation of Brighton Criteria,* 137 BRAIN 137 (2014) (Ex. E, Tab 4, p. 2) (explaining that "[re]cent studies indicate that Guillain-Barré syndrome consists of a spectrum of neuropathic disorders that may differ in underlying pathogenesis and clinical manifestations"); *accord Gross v. Sec'y of Health & Human Servs.,* No. 17-1075V, 2022 WL 9669651, at *36 (Fed. Cl. Spec. Mstr.

Sept. 22, 2022) (indicating that "the literature filed by the parties does not support the notion that gangliosides are the only player in the game of molecular mimicry").) To this point, I have previously emphasized that the "S" in GBS stands for "syndrome" and that "GBS variants are generally believed to have a multitude of both clinical presentations and causes," *McGill v. Sec'y of Health & Human Servs.*, No. 15-1485V, 2023 WL 3813524, at *27 n.16 (Fed. Cl. Spec. Mstr. May 11, 2023), raising the question of whether a single causal theory can explain every instance of GBS, post-vaccination or otherwise.

I have previously concluded that Dr. Steinman's phosphoglycerol theory is sound and reliable, and preponderantly supports a legally probable, though not scientifically certain, theory of causation sufficient to satisfy petitioner's burden of proof under *Althen* prong one, based on the same medical literature cited in this case. *Pierson v. Sec'y of Health & Human Servs.*, No. 17-1136V, 2022 WL 322836, at *27-31 (Fed. Cl. Spec. Mstr. Jan. 19, 2022); *see also Cooper v. Sec'y of Health & Human Servs.*, No. 18-1885V, 2024 WL 1522331, at *13-18 (Fed. Cl. Spec. Mstr. Mar. 12, 2024). I again reach the same conclusion based on the evidence of record in this case. Additionally, other special masters have reached similar conclusions based on substantially similar underlying evidence. *Koller,* 2021 WL 5027947, at *16-20 (Gowen); *Maloney v. Sec'y of Health & Human Servs.*, No. 19-1713V, 2022 WL 1074087, at *30-31 (Fed. Cl. Spec. Mstr. Mar. 17, 2022) (Dorsey); *Gross,* 2022 WL 9669651, at *35-36 (Dorsey); *Sprenger v. Sec'y of Health & Human Servs.*, No. 18-279V, 2023 WL 8543435, at *18-19 (Fed. Cl. Spec. Mstr. Nov. 14, 2023) (Dorsey); *Parker v. Sec'y of Health & Human Servs.*, No. 20-411V, 2023 WL 9261248, at *20-22 (Fed. Cl. Spec. Mstr. Dec. 20, 2023) (Dorsey); *Anderson v. Sec'y of Health & Human Servs.*, No. 18-484V, 2024 WL 557052, at *30-31 (Fed. Cl. Spec. Mstr. Jan. 17, 2024) (Dorsey); *see also Tracy ex rel. R.S. v. Sec'y of Health & Human Servs.*, No. 16-213V, 2022 WL 1125281, at *29-32 (Fed. Cl. Spec. Mstr. Mar. 30, 2022) (Special Master Sanders accepting a similar theory in the context of transverse myelitis).[14]

However, acceptance of this theory has not been unanimous among special masters. *Bielak v. Sec'y of Health & Human Servs.*, No. 18-761V, 2023 WL 35509, at *33-37 (Fed. Cl. Spec. Mstr. Jan. 3, 2023) (Corcoran); *Trollinger*, 2023 WL 2521912, at *26-30 (Corcoran); *Gamboa-Avila v. Sec'y of Health & Human Servs.*, No. 18-925V, 2023 WL 6536207, at *25-29 (Fed. Cl. Spec. Mstr. Sept. 11, 2023) (Corcoran), *mot. for rev. den'd*, 170 Fed. Cl. 441 (2024), *appeal filed*, No. 24-1765 (Fed. Cir. May 1, 2024); *Jaye v. Sec'y of Health & Human Servs.*, No. 20-672V, 2024 WL 3691413, at *14-17 (Fed. Cl. Spec. Mstr. July 18, 2024) (Corcoran); *Morrison v. Sec'y of Health & Human Servs.*, No. 18-386V, 2024 WL 3738934, at *19-21 (Fed. Cl. Spec. Mstr. July 18, 2024)

[14] Other special masters have also found that petitioners have preponderantly established that the Prevnar 13 vaccine case cause GBS based on the other causal theory Dr. Steinman presented. *Byrd v. Sec'y of Health & Human Servs.*, No. 20-1476V, slip op. (Fed. Cl. Spec. Mstr. July 8, 2024) (Gowen) (accepting petitioner's causal theory based on molecular mimicry between CRM197 and contactin-1); *Anderson*, 2024 WL 557052, at *31-32 (Dorsey) (same); *Sprenger*, 2023 WL 8543435, at *19-20 (Dorsey) (same); *Gross*, 2022 WL 9669651, at *36-37 (Dorsey) (same); *Maloney*, 2022 WL 1074087, at *32 (Dorsey) (same).

(Oler).[15] These contrary decisions are not binding on me. *Boatmon*, 941 F.3d at 1358-59; *Hanlon ex rel. Hanlon v. Sec'y of Health & Human Servs.*, 40 Fed. Cl. 625, 630 (1998). Nonetheless, I have considered the points raised by these decisions. I simply reach a different conclusion based on my overall weighing of the evidence on this record. Notably, even when reaching a different result, there has still been agreement that record evidence comparable to what has been presented in this case at a minimum

> *does* offer reliable support for the conclusion that phyosphoglycerol is found in the pneumococcal vaccine; that the immune system produces antibodies in reaction to the relevant antigens containing the phosphoglycerol; and that individuals with neuropathies (although some suffer from the distinguishable disease MS) have been shown in small sample studies to posses antibodies specific to myelin-containing phospholipids.

Trollinger, 2023 WL 2521912, at *28 (emphasis original).[16]

In this case, Respondent's immunology expert, Dr. Kedl, offers several arguments to rebut Dr. Steinman's phosphoglycerol theory; however, none are persuasive. First, Dr. Kedl disputes the general applicability of molecular mimicry as a casual theory for how *any* vaccine can cause GBS. (Ex. A, pp. 4-6; Ex. C, pp. 4-6; Ex. D, p. 6.) However, a *blanket* denial of the applicability of the theory would risk heightening petitioner's burden of proof. "[T]he purpose of the Vaccine Act's preponderance standard is to allow the finding of causation in a field bereft of complete and direct proof of how vaccines affect the human body." *Althen*, 418 F.3d at 1280. The preponderant standard "does not operate as a sliding scale that varies depending upon the quantity and quality of scientific evidence that is available," *Caves v. Sec'y of Health & Human Servs.*, 100 Fed. Cl. 119, 143 (2011), *aff'd*, 463 F. App'x 932 (Fed. Cir.

[15] Some additional cases were resolved against petitioners based on different theories of causation. *McConnell v. Sec'y of Health & Human Servs.*, No. 18-1051V, 2022 WL 4008238, at *7-9 (Fed. Cl. Spec. Mstr. Aug. 19, 2022); *Deshler*, 2020 WL 4593162, at *19-21.

[16] In his most recent decision regarding whether the Prevnar 13 vaccine can cause GBS, Chief Special Master Corcoran noted that my decision in *Cooper* "underscored the overlap . . . with the intent of emphasizing how little separates" the special masters' disparate findings regarding the persuasiveness of Dr. Steinman's causal theory. *Jaye*, 2024 WL 3691413, at 17 n.20. I at least partly agree with the Chief Special Master that "the varying outcomes in these cases more likely results from differences of opinion about the proper application of the *Althen* prong one evidentiary standard." *Id.* However, there have also been some significant differences in the record evidence of the various decisions weighing the theory Dr. Steinman presents in this case. For instance, while some prior cases denying compensation for GBS based on this theory found significance in the distinction between B- and T-cell responses, respondent's expert in *Cooper* specifically disclaimed a hardline distinction between such responses, testifying instead that "nothing is pure B cell/Tcell". *Compare Cooper*, 2024 WL 1522331, at *17, *with Deshler*, 2020 WL4593162, at *19-20, *and Bielak*, 2023 WL 35509, at *29-37. More recently, the *Morrison* decision turned in part on acceptance of the pathological role of anti-ganglioside antibodies in GBS as suggested by Dr. Whitton. *Morrison*, 2024 WL 3738934, at 19-21. Yet, respondent's expert in this case, Dr. Kedl, asserts to the contrary that this is "tenuous, speculative and clinically unproven," and that "the vast majority of literature stands in sharp contrast to the assertion that there is any causal relationship between ganglioside-specific antibodies and GBS." (Ex. A, p. 5, 6.)

2012), but nor should the evidence be viewed "through the lens of the laboratorian," *Andreu*, 569 F.3d at 1380. Even the literature cited by respondent, including the IOM, accepts the general viability of molecular mimicry as a concept. (Yuki et al., *supra*, at Ex. A, Tab 27, p. 1; IOM 2012 Report, *supra*, at Ex. E, Tab 12, p. 10.) Moreover, molecular mimicry is a well-established theory that has persuasively linked vaccines to autoimmune conditions, including GBS. *See, e.g.*, *Conte v. Sec'y of Health & Human Servs.*, No. 17-403V, 2020 WL 5743696, at *23 (Fed. Cl. Spec. Mstr. July 27, 2020) (noting the theory of molecular mimicry in a GBS case is "well-established and well-settled in the Vaccine Program"); *Barone v. Sec'y of Health & Human Servs.*, No. 11-707V, 2014 WL 6834557, at *8 (Fed. Cl. Spec. Mstr. Nov. 12, 2014) (noting molecular mimicry "has been accepted in other Program cases as a reliable medical explanation for how various autoimmune conditions could develop after the receipt of different kinds of vaccinations").

Second, Dr. Kedl disputes that phosphoglycerol antibodies in the Prevnar 13 vaccine would preferentially target phosphoglycerol lipids in the myelin sheath or the peripheral nerves without also targeting the other phosphoglycerol-based lipids throughout the rest of the body. (Ex. I, p. 3.) However, Dr. Steinman explains that it is biologically plausible for a widespread antigen to trigger organ-specific diseases. (Ex. 163, pp. 4-6.) By way of example, Dr. Steinman points to the well-established association between *C. jejuni* and gangliosides, which he describes as "one of the classic antigens associated with GBS." (*Id.* at 5, 10-11.) He notes that gangliosides are present in the central and peripheral nervous systems, as well as in the bone marrow, erythrocytes, intestine, liver, spleen, and testis; however, an immune response to gangliosides in *C. jejuni* "only leads to GBS," a peripheral nervous system disorder. (*Id.* (citing Yuki, *supra*, at Ex. 169; Thomas Kolter, *Ganglioside Biochemistry*, INT'L SCHOLARLY RSCH. NETWORK BIOCHEMISTRY, Dec. 2012, at 1 (Ex. 170)).)

Third, Dr. Kedl contends that the Nakos et al. study, one of the two studies showing GBS patients to have anti-phospholipid antibodies, undermines Dr. Steinman's theory. Specifically, he points to the fact that the subjects in the Nakos et al. study were administered IVIg containing anti-phospholipid antibodies. (Ex. I, pp. 3-5 (citing Nakos et al., *supra,* at Ex. 142).) Dr. Kedl explains that IVIg is the "only really successful treatment for GBS" and asserts that "[i]f anti-phospholipid antibodies were a consistent contributor to neuropathological symptoms, then infusing a large bolus of gamma-globulin containing anti-phospholipid activity would be contraindicative for GBS, not therapeutic." (*Id.* at 3-4.) However, the Nakos authors do account for the possibility that an initial increase in anti-phospholipid antibodies could be attributable to the contents of the IVIg as Dr. Kedl contends, given that the antibodies were significantly increased one hour after treatment. Nonetheless, they still concluded that it is possible the gamma-gobulin ultimately has an overall blocking effect on anti-phospholipid antibodies given that they found the antibodies were subsequently significantly reduced one day after treatment. (Nakos et al., *supra*, at Ex. 142, p. 6.) In that regard, Dr. Kedl concedes that the means by which IVIg has its therapeutic effect are "far from completely understood." (Ex. I, p. 5.) Additionally, Dr. Kedl and Dr. Steinman have filed competing studies with respect to whether commercially available IVIg preparations generally do contain meaningful levels of these autoantibodies. (*Compare* Krause et

al., *supra*, at Ex. I, Tab 1 (finding three commercial preparations include significant anti-phospholipid antibodies but concluding based on a mouse model they are not pathologic), *with* Sherer et al., *supra*, at Ex. 173 (finding five commercial preparations of IVIg did not include sufficient levels of anti-phospholipid antibodies to be disease modifying).) The Sherer et al. study cited by Dr. Steinman would seem to rebut Dr. Kedl's premise that IVIg contains a "large bolus" of these antibodies. (Ex. I, p. 4.) That study concluded that IVIg is safe for patients with Hughes syndrome, a disorder known to be mediated by antiphospholipid antibodies. (Sherer et al., *supra*, at Ex. 173, pp 1, 3.) Ultimately, Nakos et al. were unable to discern a relationship between antibody levels and outcomes, which they attributed to the small size of the study and the variety of possible GBS presentations. (Nakos et al., *supra*, at Ex. 142, p. 7.) In that regard, Dr. Steinman stresses that Dr. Kedl's observation relies on an aspect of the study for which the authors specified "data not shown." (Ex. 163, p. 7 (citing Nakos et al., *supra,* at Ex. 142, p. 5).) Dr. Steinman cites several potentially confounding variables that could be reflected in the missing data. (*Id.* at 7-8.)

Finally, I note briefly that I have also considered the opinions of respondent's neurology experts with respect to *Althen* prong one. Dr. Callaghan questioned the relevance of the two case reports cited by petitioner's experts (Hassan El Khatib et al., *Case Report: Guillain-Barre Syndrome with Pneumococcus – A New Association in Pediatrics,* 11 IDCASES 36 (2018) (Ex. 92); Ravishankar, *supra*, at Ex. 160), asserting that they do no more than show a temporal association between infection or vaccination and injury. (Ex. G, p. 3.) However, although case reports "are not entirely devoid of evidentiary value," *Kaltenmark ex rel. A.J.K. v. Sec'y of Health & Human Servs.*, No. 17-1362V, 2023 WL 8870299, at *30 n.30 (Fed. Cl. Spec. Mstr. Nov. 27, 2023); *Paluck ex rel. Paluck v. Sec'y of Health & Human Servs.*, 104 Fed. Cl. 457, 475 (2012), this case does not turn on the availability of case reports. Dr. Callaghan also cited Haber et al., as finding that the incidence of GBS did not exceed what would be expected in the general population. (Ex. G, p. 3 (citing Haber et al., *supra*, at Ex. 161).) However, in a prior case, Dr. Callaghan conceded during testimony that the Haber study is not strong evidence. *Cooper*, 2024 WL 1522331, at *17 n.17. In any event, petitioner's experts do not dispute that GBS is a rare condition. (Ex. 18, p. 4; Ex. 129, p. 6.) Dr. Chaudhry argued that it is unlikely that the Prevnar 13 vaccine, which protects against *Streptococcus pneumonia*, could cause GBS where there has been no established relationship between the bacterium and GBS. (Ex. E, pp. 15, 17-18.) Although helpful when present, petitioners need not "demonstrate that a vaccine's infectious counterpart is a known-disease trigger." *Morrison*, 2024 WL 3738934, at *18. Petitioners similarly need not present epidemiologic evidence to support their claim. *Andreu*, 569 F.3d at 1378. Thus, although respondent's neurology experts' contentions represent at least some evidence inconsistent with petitioner's theory, they are insufficient to contradict the evidence presented in support of Dr. Steinman's theory.

In light of the above, petitioner has satisfied the first *Althen* prong by preponderant evidence.

b. *Althen* prong two

The second *Althen* prong requires preponderant proof of a logical sequence of cause and effect, which is usually supported by facts derived from petitioner's medical records. *Althen*, 418 F.3d 1278; *Andreu*, 569 F.3d at 1375-77; *Capizzano*, 440 F.3d at 1326; *Grant*, 956 F.2d at 1148. Medical records are generally viewed as trustworthy evidence. *Cucuras ex rel. Cucuras v. Sec'y of Health & Human Servs.*, 993 F.2d 1525, 1528 (Fed. Cir. 1993). These records are generally contemporaneous to the medical events and "contain information supplied to or by health professionals to facilitate diagnosis and treatment of medical conditions. With proper treatment hanging in the balance, accuracy has an extra premium." *Id.* However, medical records and/or statements of a treating physician's views do not per se bind the special master. § 300aa-13(b)(1) (providing that "[a]ny such diagnosis, conclusion, judgment, test result, report, or summary shall not be binding on the special master or court"); *Snyder ex rel. Snyder v. Sec'y of Health & Human Servs.*, 88 Fed. Cl. 706, 746 n.67 (2009) (reasoning that "nothing . . . mandates that the testimony of a treating physician is sacrosanct—that is must be accepted in its entirety and cannot be rebutted"). A petitioner may support a cause-in-fact claim through presentation of either medical records or expert medical opinion. *See* § 300aa-13(a). The special master is required to consider all relevant evidence of record, draw plausible inferences, and articulate a rational basis for the decision. *Winkler v. Sec'y of Health & Human Servs.*, 88 F.4th 958, 963 (Fed. Cir. 2023) (citing *Hines*, 940 F.2d at 1528).

Although there was some initial disagreement regarding diagnosis, Dr. Callaghan ultimately concedes on behalf of respondent that petitioner likely suffered from GBS. (Ex. G, pp. 3-4.) Petitioner's diagnostic work up was limited; however, Dr. Sheikh opines, and Dr. Callaghan agrees, that petitioner's positive response to IVIg supports his GBS diagnosis. (*Id.* at 3; Ex. 51, pp. 9-10; Ex. 16, pp. 519-24, 531; Ex. 2, p. 204.) Additionally, Dr. Sheikh opines that, although diagnostically helpful, a spinal tap or nerve conduction study only provide indirect evidence of demyelination or inflammation and "[t]he only definitive way of demonstrating immune infiltration and demyelination is nerve pathology, which is not [the] standard of care for the management of GBS." (Ex. 51, p. 9.) He persuasively opines that petitioner's treaters did not deem a spinal tap or nerve conduction study diagnostically necessary as petitioner's clinical presentation, responsiveness to IVIg treatment, and clinical course were all consistent with GBS. (*Id.* at 9-10.)

With diagnosis established, the fact that petitioner has satisfied *Althen* prongs one and three is significant to the *Althen* prong two analysis. *See Capizanno*,440 F.3d at 1326. Ordinary medical care offers little beyond clinical history that would confirm the cause of GBS. Nonetheless, petitioner points to several medical records to support his contention that his treating physicians attributed his condition to his Prevnar 13 vaccination, although he acknowledges that none of his physicians "expressed absolute certainty as to vaccine causality." (ECF No. 119, pp. 76-77 (citing Ex. 2, p. 95; Ex. 5, p. 15; Ex. 15, p. 29).) On at least one occasion, petitioner's treating neurologist noted his recent Prevnar vaccination before providing a differential diagnosis of acute

demyelinating polyneuropathy. (Ex. 2, pp. 278-79.) Moreover, petitioner's treating physicians added the Prevnar vaccine to his allergy list (*Id.* at 91, 204; Ex. 4, p. 51; Ex. 15, p. 40), demonstrating at least some evidence that their opinion was not limited to a temporal association between the vaccine and injury. *See Andreu*, 569 F.3d at 1376-77 ("A treating physician's recommendation to withhold a particular vaccination can provide probative evidence of a causal link between the vaccination and the injury a claim has sustained."); *see also, e.g.*, *Capizzano*, 440 F.3d at 1320, 1326-27 (concluding that the chief special master erred in part because he failed to consider the fact that petitioner's treater decided that she should not receive the third hepatitis B vaccination in the series as evidence in support of *Althen* prong two); *Kelley v. Sec'y of Health & Human Servs.*, 68 Fed. Cl. 84, 100 (2005) (relying in part on petitioner's treater's reported hesitancy to administer further tetanus shots as evidence in support of the second *Althen* prong). Respondent's additional argument that petitioner's treating neurologist's opinion should be given less weight specifically because it does "not discuss a theory of causation," (ECF No. 123, p. 41), also fails as "[a]ny expectation that treating physicians will record the precise biological theories behind their belief that a patient's condition was caused by a particular trigger is discordant with the reality of medical treatment." *Campbell v. Sec'y of Health & Human Servs.*, 97 Fed. Cl. 650, 667 (2011).

Additionally, petitioner's experts opine that the Prevnar 13 vaccine "did cause" his GBS. His experts readily admit that he underwent a limited work up; however, they suggest that this fact underscores that there was low clinical suspicion of any alternative cause and no alternate explanation emerged. (*See* Ex. 18, p. 9; Ex. 163, p. 27.) They point to the fact that there is no evidence of upper respiratory tract infection, diarrheal illness, or any other significant medical event preceding onset of petitioner's GBS. (Ex. 18, p. 9; Ex. 51, p. 3; Ex. 163, p. 27.) Petitioner need not rule out all alternative causes; however, "petitioner is certainly permitted to use evidence eliminating other potential causes to help carry the burden on causation." *Walther*, 485 F.3d at 1151. Thus, it is notable that there was no other cause that petitioner's treaters believed to be the more likely cause of his GBS. *See Campbell,* 97 Fed. Cl. at 671; *Capizzano v. Sec'y of Health & Human Servs.*, No. 00-759V, 2006 WL 3419789, at *11 (Fed. Cl. Spec. Mstr. Nov. 8, 2006).

Setting aside the possible acute causes of GBS, respondent also argues that petitioner must demonstrate that "his pre-existing conditions were not the cause of his symptoms and resulting injuries." (ECF No. 123, pp. 42.) Respondent asserts that it is petitioner's burden "to confront other possible grounds of causation evidence in the record." (*Id*. at 42-43 (citing *Capizzano*, 440 F.3d at 1327).) While this is true, it is also the case that petitioners do not bear a burden to "discount *every* potential cause that exists within the entire realm of possibility." *Pafford ex rel. Pafford v. Sec'y of Health & Human Servs.*, 64 Fed. Cl. 19, 35 (2005), *aff'd*, 451 F.3d 1352 (Fed. Cir. 2006). Here, respondent presents a broad list of prior conditions without any specific suggestion that any of the identified conditions either explains petitioner's post-vaccination presentation or constitutes any known cause of GBS.[17] It is difficult to see how this line of argument

[17] Respondent simply notes without explanation that petitioner's pre-existing conditions include: hypertension, diabetes mellitus, hyperlipidemia, coronary artery disease, status-post coronary artery

is not entirely obviated by Dr. Callaghan's ultimate clinical assessment on respondent's behalf that petitioner was suffering from idiopathic GBS. (Ex. G, p. 4.) Dr. Callaghan, opines of petitioner's GBS that "the cause is unclear."[18] (*Id.*)

Dr. Kedl also opines that, because GBS is frequently preceded by infection, an undetected, subclinical infection is a more likely cause of petitioner's GBS. (Ex. A, pp. 9-10.) However, the Federal Circuit has previously held that "statistical likelihood alone cannot support actual causation." *Boatmon*, 941 F.3d at 1363; *see also Knudsen*, 35 F.3d at 550 ("The bare statistical fact that there are more reported cases of viral encephalopathies than there are reported cases of [post-vaccination] encephalopathies is not evidence that in a particular case an encephalopathy following . . . vaccination was in fact caused by a viral infection . . . and not caused by the . . . vaccine."). Moreover, Dr. Kedl's arguments in this regard are couched in his ultimate disagreement with petitioner's causal theory, which has already been resolved under *Althen* prong one.

Accordingly, petitioner has satisfied his burden of preponderantly proving a logical sequence of cause and effect under the second *Althen* prong.

c. *Althen* prong three

Under the third *Althen* prong, a petitioner must demonstrate a "proximate temporal relationship" between the subject vaccination and the alleged injury. *Althen*, 418 F.3d at 1278. To do this, petitioner must provide "preponderant proof that the onset of symptoms occurred within a timeframe for which, given the medical understanding of the disorder's etiology, it is medically acceptable to infer causation-in-fact." *de Bazan*, 539 F.3d at 1352 (citations omitted).

In this case, the parties agree that petitioner experienced onset of symptoms within 22 days, or approximately 3 weeks, following his Prevnar 13 vaccination. (Ex. G, p. 3; Ex. 18, p. 9; Ex. 129, p. 27.) Petitioner's experts opine that this timeframe is consistent with both petitioner's proposed medical theory and the medical literature concerning timing of post-vaccination GBS. (Ex. 129, p. 27 (citing Schonberger, *supra*, at Ex. 162).) Respondent argues, however, that petitioner's experts' reliance on evidence pertaining to the flu vaccine to evidence the appropriate timeframe for onset in

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bypass graft and stent placement, ischemic cardiomyopathy and related congestive heart failure, paroxysmal atrial fibrillation, prostatic hypertrophy, venous insufficiency, peripheral vascular disease, GERD, multiple previous surgeries, a history of multifocal paresthesia in 2012 related to vitamin B12 deficiency, and chronic vitamin B12 repletion at the time of vaccination. (ECF No. 123, p. 43.)

[18] To the extent that Dr. Kedl had previously raised many of these conditions as predisposing petitioner to inflammation (Ex. A, p. 9; Ex. C, p. 3), this reasoning would not defeat petitioner's claim absent some indication that these conditions are causes of GBS in themselves. A predisposition to inflammation is not incompatible with vaccine causation. Petitioner's burden is to prove that his vaccination was a substantial contributing factor, not that his vaccination was the sole or predominant cause of his condition. Accordingly, even if petitioner's pre-existing conditions had operated in conjunction with his vaccination to cause his GBS, petitioner could still meet his burden under the second *Althen* prong. *See Shyface*, 165 F.3d at 1352-53.

this case is unreliable. (ECF No. 123, pp. 39-40.) He contends that this is not rooted in the experts' theory of causation relative to the Prevnar vaccine and that it is inappropriate for a claimant to "piggyback" on Table injury requirements. (*Id*.)

Schonberger et al. conducted an epidemiologic study that evaluated over 1,000 individuals who were diagnosed with GBS between October 1, 1976, and January 31, 1977. (Schonberger et al., *supra*, at Ex. 162, p. 5.) The authors found that fifty-two percent of vaccinated cases included an onset of within one-to-two weeks following vaccination. (Schonberger et al., *supra*, at Ex. 162, pp. 6, 8 fig.4.) That percentage increased to seventy-one percent within four weeks following vaccination. (*Id.*) Although respondent is correct to note that this case involves a different vaccine, the 1976 Swine flu vaccine is the only vaccination for which there is robust epidemiologic data. Therefore, the post-Swine flu vaccine findings have been a significant consideration assessing risk periods to be examined when studying other possible causes of GBS. (*E.g.*, Roger Baxter et al., *Lack of Association of Guillain-Barré Syndrome with Vaccinations*, 57 CLINICAL INFECTIOUS DISEASES 197 (2015) (Ex. E, Tab 6) (using a 6-week interval for studying multiple vaccines and GBS based on the swine flu vaccine findings).) As a general matter, Baxter et al. observed that, to the extent GBS is generally accepted as a post-infectious autoimmune process, "most published case series report that approximately two-thirds of all cases [of GBS] are preceded by a gastrointestinal or respiratory infection within the prior 3 months." (*Id.* at 1.) Regarding molecular mimicry specifically, the IOM indicates that prior study has shown *C. jejuni* infection precedes GBS by a "few weeks" in about a quarter of patients. (IOM 2012 Report, *supra*, at Ex. E, Tab 12, p. 11.) A mouse model used in examining molecular mimicry as a cause of GBS found that it took two or more weeks for an injection of anti-GM1 IgG to result in limb weakness. (Yuki et al., *supra*, at Ex. A, Tab 27, pp. 4-5.) Thus, even setting the Schonberger et al. findings aside, there is still evidence to support the general proposition that molecular mimicry can lead to clinically apparent demyelination, and GBS specifically, over the course of several weeks. Special masters have generally recognized eight weeks as the appropriate timeframe for onset of GBS. *E.g.*, *Pierson*, 2022 WL 322836, at 32-38; *Barone,* 2014 WL 6834557, at *12-13.

Accordingly, petitioner has preponderantly demonstrated a medically acceptable timeframe to infer causation and satisfied his burden under the third *Althen* prong.

d. Factor unrelated

Once petitioner has satisfied his own burden of proof, the burden shifts to respondent to demonstrate by a preponderance of the evidence that the injury was caused by factors unrelated to vaccination. § 300aa-13(a)(1)(B); *Deribeaux ex rel. Deribeaux v. Sec'y of Health & Human Servs.*, 717 F.3d 1363, 1367-69 (Fed. Cir. 2013). In this case, respondent has not offered any other fact as a potential cause of petitioner's GBS. (*See* ECF No. 123, pp. 43-45.)

VI. Conclusion

After weighing the evidence of record within the context of this program, I find by preponderant evidence that petitioner suffered GBS caused-in-fact by the Prevnar 13 vaccination he received on July 13, 2016. A separate damages order will be issued.

IT IS SO ORDERED.

s/Daniel T. Horner
Daniel T. Horner
Special Master